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
- Electrical Engineering Technology (EET)
- Manufacturing Engineering Technology
- Technology and Engineering Education—Teaching

Undergraduate Majors (B.A.)
- Graphic Technologies
- Technology Management
- Combined B.A./M.S. or B.S./M.S. - Technology

Undergraduate Major (B.A.S.)
- Technology

Minors
- Electrical and Electronics Technology (EET)
- Graphic Technologies
- Manufacturing Technology Design
- Technology Education - Teaching
- Technology Management

Graduate Major (M.S.)
- Technology

Graduate Major (D.I.T.)
- Doctor of Industrial Technology

Program Certificates
- Technology Management

Bachelor of Science Degree Programs

Construction Management Major (Extended Program)
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 core:
Construction science/construction: 51

TECH 1018 (330:018) Construction Resources
TECH 1025 (330:025) Construction Graphics
TECH 2045 (330:045) Construction Law and Documentation
TECH 2080 (330:080) Statics and Strength of Materials
TECH 2096 (330:096) Construction Safety
TECH 3125/5125 (330:125g) Commercial and Heavy/Highway Construction
TECH 3126/5126 (330:126g) Land, Route, and Construction Surveying
TECH 3128 (330:128) Electrical Construction Materials and Methods
TECH 3149 (330:149) Construction Estimating
TECH 4100 (330:100) Undergraduate Research in Construction Management
TECH 4124/5124 (330:124g) Mechanical Systems in Construction Management
TECH 4153/5153 (330:153g) Construction Project Planning, Scheduling and Controlling
TECH 4154/5154 (330:154g) Computerized Construction Estimating
TECH 4173/5173 (330:173g) Construction Management
TECH 4175/5175 (330:175g) Structural Analysis in Construction
TECH 4185/5185 (330:185g) Methods Improvement and Construction Innovations

Required:
Business and Management: 18
Accounting:
ACCT 2120 (120:030) Principles of Financial Accounting
Management:
MGMT 2080 (150:080) Introduction to Information Systems
MGMT 3101 (150:101) Business Law
MGMT 3145 (150:145) Information Systems Applications
Economics
ECON 1021 (920:020) Decision Analytics *
ECON 1031 (920:024) Introduction to Economics
Mathematics and Science: 15
Mathematics:
MATH 1420 (800:060) Calculus I^ or MATH 1150 (800:048) Calculus for Technology
STAT 1772 (800:072) Introduction to Statistical Methods ^
Chemistry and Biochemistry:
CHEM 1110 (860:044) General Chemistry I ^ or CHEM 1020 (860:020) Chemical Technology
**Electrical Engineering Technology (EET) Major**

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:**

<table>
<thead>
<tr>
<th>Mathematics:</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1140 (800:046)</td>
<td>Precalculus</td>
</tr>
<tr>
<td>MATH 1150 (800:048) or MATH 1420 (800:060)</td>
<td>Calculus for Technology or Calculus I</td>
</tr>
<tr>
<td>STAT 1774 (800:064) or STAT 1772 (800:072)</td>
<td>Introductory Statistics for Life Sciences or Introduction to Statistical Methods</td>
</tr>
</tbody>
</table>

**Physics:**

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

**Total Hours**  

| 84 |

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

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**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.

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**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:**

<table>
<thead>
<tr>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1150 (800:048)</td>
</tr>
<tr>
<td>or MATH 1420 (800:060)</td>
</tr>
</tbody>
</table>

**Chemistry and Biochemistry:**

| CHEM 1020 (860:020) | Chemical Technology |
| or CHEM 1110 (860:044) | General Chemistry I |

**Physics:**

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

**Required Technical Core:**

| 52 |

**Computer Science:**

| CS 1160 (810:036) or CS 1130 (810:030) | C++ Programming or Visual BASIC Programming |

**Physics:**

| PHYSICS 1511 (880:054) | General Physics I |
| PHYSICS 1512 (880:056) | General Physics II |

**Total Hours**  

| 77 |

**Required Technical Core:**

<table>
<thead>
<tr>
<th>0-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1017 (330:017)</td>
</tr>
<tr>
<td>TECH 1008 (330:008)</td>
</tr>
<tr>
<td>TECH 1010 (330:010)</td>
</tr>
</tbody>
</table>

| TECH 3160/5160 (330:160g) | Computer-Aided Instrumentation and Interfacing |
| TECH 3164/5164 (330:164g) | Programmable Logic Controllers (PLCs) |
| TECH 3166/5166 (330:166g) | Advanced Electrical Power Systems |
| TECH 4103/5103 (330:103g) | Electronic Communications |
| TECH 4104/5104 (330:104g) | Applied Digital Signal Processing |
| TECH 4165/5165 (330:165g) | Wireless Communication Networks |
| TECH 4167/5167 (330:167g) | Power Electronics Applications |
| TECH 4174 (330:174) | Senior Design I |
| TECH 4176 (330:176) | Senior Design II |

**Required Technical Writing:**

<table>
<thead>
<tr>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGLISH 3772/5772</td>
</tr>
</tbody>
</table>

**Total Hours**

| 77 |

---

---
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1024</td>
<td>Technical Drawing and Design I</td>
</tr>
<tr>
<td>TECH 2024</td>
<td>Technical Drawing and Design II</td>
</tr>
<tr>
<td>TECH 2060</td>
<td>Fundamentals of Automated Manufacturing</td>
</tr>
<tr>
<td>TECH 2072</td>
<td>Engineering Materials</td>
</tr>
<tr>
<td>TECH 2080</td>
<td>Statics and Strength of Materials</td>
</tr>
<tr>
<td>TECH 3142</td>
<td>Statistical Quality Control</td>
</tr>
<tr>
<td>TECH 3143</td>
<td>Managing Operations and Manufacturing Systems</td>
</tr>
<tr>
<td>TECH 3180</td>
<td>Lean and Sustainable Operations</td>
</tr>
<tr>
<td>TECH 3196</td>
<td>Industrial Safety</td>
</tr>
<tr>
<td>TECH 4110/5110</td>
<td>Manufacturing Process Planning</td>
</tr>
<tr>
<td>TECH 4187/5187</td>
<td>Applied Industrial Supervision and Management</td>
</tr>
<tr>
<td>TECH 4210</td>
<td>Manufacturing Senior Projects</td>
</tr>
</tbody>
</table>

Concentration: choose one of the following three concentrations: 12 Total Hours 66-69

* Equivalency requires approval by department.

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

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

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

Recommended elective hours from the following:

**Technology:**
- TECH 1037 (330:037) Introduction to Circuits
- TECH 2036 (330:036) Power Technology
- TECH 2038 (330:038) Introduction to Electrical Power and Machinery
- TECH 2119 Computer Applications in Technology

**Advanced Manufacturing:**
- TECH 3113 (330:113) Manufacturing Tooling
- TECH 3127 (330:127) Transport Phenomena for Technologists
- TECH 3131/5131 (330:131g) Technical Project Management
- TECH 3177 (330:177g) Advanced Manufacturing Processes
- TECH 3179 (330:179) "Cooperative Education" (3 hrs. maximum)
- TECH 3183 (330:183) Fundamentals of Manufacturing Engineering
- TECH 3192/5192 (330:192g) Non-Destructive Evaluation of Materials/Scanning Electron Microscopy

**TECH 4162 Automation - Pneumatics and Hydraulics**

**Management:**
- MGMT 3113 (150:113) Business Communication

**Communication:**
- COMM 3155 (48C:173) Business and Professional Oral Communication
- COMM 4355/5355 (48C:141g) Listening

**Philosophy:**
- PHIL 2500 Ethics

**Sociology:**
- SOC 3090 (980:102) Conflict Resolution

**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.

**Technology and Engineering Core**
- 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
- TECH 1008 (330:008) Basic Manufacturing Processes 3
- TECH 1010 (330:010) Metal Removal Processes 3
- TECH 1018 (330:018) Construction Resources 3
- TECH 1006 Project Lead The Way: Introduction to Engineering Design 3
- TECH 1022 (330:022) Communication Technology 3
- TECH 1024 (330:024) Technical Drawing and Design I 3
- TECH 3010 Project Lead The Way: Principles of Engineering 3
- TECH 3114 (330:114) Product Development and Enterprise 3
- TECH 4290/5290 Project Lead The Way: Digital Electronics 3
Department of Technology

or PHYSICS 4290/5290  Project Lead The Way: Digital Electronics

Technology and Engineering Electives: (choose from communication, construction, manufacturing, power and energy, and transportation and should have at least six hours in any three of these areas.)  9

Technology and Engineering Education Core:  12
TECH 1019 (330:019)  Introduction to Technology and Engineering Education
TECH 3120 (330:120)  Technology and Engineering Education Curriculum Planning
TECH 3190/5190 (330:190g)  Technology and Engineering Education Teaching Methods (Includes level 3 field experience: prerequisite or co-requisite: EDPSYCH 3128 level 2 field experience.)
TECH 4195/5195 (330:195g)  Technology and Engineering Education Laboratory Management

Total Hours  60

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 Arts Degree Programs

Graphic Technologies Major
The Graphic Technologies major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements (45 hours) and the following specified major requirements (61 hours), plus university electives (14 hours) to complete the minimum of 120 hours.

The Graphic Technologies major provides students with theoretical and hands-on experiences in the graphic communication industry and related disciplines. This major prepares students for careers in printing, packaging, publishing, imaging, management, marketing, art, journalism, public relations, and/or computation. The Graphic Technology program is accredited by Accrediting Council for Collegiate Graphic Communications, Inc. (acccgc.org) and Association of Technology, Management, and Applied Engineering (atmae.org).

Required:
TECH 1012  ePortfolio Development & Industry Exploration  3
TECH 1055 (330:055)  Graphic Communications Foundations  3
TECH 2070 (330:070)  Digital Pre-Media  3
TECH 2119  Computer Applications in Technology  3
TECH 3144 (330:144)  Web Publishing  3
TECH 3150/5150 (330:150g)  Graphic Communications Imaging  3
TECH 3163/5163 (330:163g)  Advanced Digital Pre-Media  3
TECH 3169 (330:169)  Digital Imaging  3
TECH 3179 Cooperative Education  3
TECH 4093/5093  Graphic Communications Estimating and Management I  3
TECH 4158/5158 (330:158g)  Graphic Communications Technical Visualization  3
TECH 4161/5161 (330:161g)  Digital Graphic Communications  3
TECH 4187/5187 (330:187g)  Applied Industrial Supervision and Management  3
TECH 4193  Graphic Communication Estimating and Management II  3

Total Hours  42

Technology Management Major
The Technology Management 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.

Mathematics and Science Core: (one hour lab required)  10
STAT 1772 (800:072)  Introduction to Statistical Methods
CHEM 1010 (860:010)  Principles of Chemistry
or CHEM 1020 (860:020)  Chemical Technology
or CHEM 1110 (860:044)  General Chemistry I
PHYSICS 1000 (880:012)  Physics in Everyday Life
or PHYSICS 1400 (880:011)  Conceptual Physics
or PHYSICS 1511 (880:054)  General Physics I

Management:  21
TECH 3065  Technology and Organizational Efficiency
TECH 3131/5131 (330:131g)  Technical Project Management
TECH 3142 (330:142)  Statistical Quality Control
TECH 3143  Managing Operations and Manufacturing Systems
TECH 3168/5168 (330:168g)  Technology Training Strategies
TECH 3180 (330:180)  Lean and Sustainable Operations
TECH 4187/5187 (330:187g)  Applied Industrial Supervision and Management

Technical Electives: **  36
TECH 1008 (330:008)  Basic Manufacturing Processes
TECH 1010 (330:010)  Metal Removal Processes
TECH 1011  Introduction to Graphic Programs
TECH 1017 (330:017)  Computer-Aided Design and Drafting
TECH 1018 (330:018)  Construction Resources
TECH 1022 (330:022)  Communication Technology
TECH 1024 (330:024)  Technical Drawing and Design
Department of Technology

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* 9
2. Category 2: Civilizations & Cultures (1 course from Category 2A or 2B) 3
3. Category 3: Fine Arts, Literature, Philosophy & Religion (1 course from Category 3A or 3B) 3
4. Category 4: Natural Science & Technology (1 course from Category 4A or 4B) 3
5. Category 5: Social Science (1 course from Category 5A, 5B, or 5C) 3
6. Category 6: Capstone Experience (1 course)(2-3 hours or 1 additional course from BAS LAC Category 2, 3, 4, or 5) 2-3

Total Hours 23-24

Combined B.A./M.S. or B.S./M.S. - Technology

Students with majors in a Department of Technology program, interested in the combined program should declare their intent by the end of the junior year (or have completed at least 90 semester hours). They should complete an Application for Admission to Graduate Study and the departmental application, as well as two professional references and have them submitted to the Graduate Coordinator before attempting to register. Application for graduate admission can be found at www.grad.uni.edu/admission.

Upon admittance to the combined B.A./M.S. or B.S./M.S. program, undergraduate students during their senior year may register for a maximum of 12 hours of graduate credit as a senior, with the approval of the student’s advisor, the instructor of the course(s), and the head(s) of the department(s) offering the course(s). The admitted student may enroll and self-identify themselves with every instructor in the first two weeks of the semester in these 9 hours during the senior year, but before the baccalaureate degree is awarded. To be eligible for this exception to the undergraduate registration policies, the student must have earned at least 90 hours with a cumulative GPA of 3.00 or higher at the time of registration. When registering for the graduate courses, approvals must be obtained on the same student request, with the IT Graduate Coordinator serving as the advisor. (See policies and procedures for Graduate Credit for Undergraduate Students.)

Graduate work completed on the early admission basis will be counted as graduate credit only after the baccalaureate degree has been awarded and enrolled for graduate course work within one year of the awarding of the baccalaureate degree. Actual admission to graduate study and classification as a graduate student commences the term after the student has completed the baccalaureate.
Professional Communication Required Courses for B.A.S. Degree

Required:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM 3155</td>
<td>Business and Professional Oral Communication</td>
<td>3</td>
</tr>
<tr>
<td>ENGLISH 3770</td>
<td>Technical Writing in Applied Sciences</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 6

Technology

Mathematics and Science Core:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1020</td>
<td>Chemical Technology (either of these courses will satisfy LAC Category 4B)</td>
<td>4</td>
</tr>
<tr>
<td>PHYSICS 1511</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>STAT 1772</td>
<td>Introduction to Statistical Methods (will satisfy LAC Category 1C)</td>
<td>3</td>
</tr>
</tbody>
</table>

BAS Technology Core

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 2119</td>
<td>Computer Applications in Technology</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3196</td>
<td>Industrial Safety</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3131/3131</td>
<td>Technical Project Management</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3102</td>
<td>Living in Our Techno-Social World (will satisfy LAC Category 6)</td>
<td>3</td>
</tr>
</tbody>
</table>

Elective approved by the department (must be 3000-level or above) 3

BAS Technology Upper Division Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 3121/5121</td>
<td>Applied Technology Systems</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3142</td>
<td>Statistical Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3180</td>
<td>Lean and Sustainable Operations</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3143</td>
<td>Managing Operations and Manufacturing Systems</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3168/5168</td>
<td>Technology Training Strategies</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4187/5187</td>
<td>Applied Industrial Supervision and Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 37*

*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:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1037</td>
<td>Introduction to Circuits</td>
<td>3</td>
</tr>
<tr>
<td>TECH 1039</td>
<td>Circuits and Systems</td>
<td>3</td>
</tr>
<tr>
<td>TECH 2038</td>
<td>Introduction to Electrical Power and Machinery</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 18

Mathematics:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1150</td>
<td>Calculus for Technology</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1420</td>
<td>Calculus I</td>
<td>3</td>
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</table>

Computer Science:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 1130 or CS 1160</td>
<td>Visual BASIC Programming</td>
<td>3</td>
</tr>
<tr>
<td>or CS 1160</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</td>
<td>General Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYSICS 1701</td>
<td>Physics I for Science and Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 29

Graphic Technologies Minor

Required:

<table>
<thead>
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<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 2041</td>
<td>Introduction to Analog Electronics</td>
<td>3</td>
</tr>
<tr>
<td>TECH 2042</td>
<td>Introduction to Digital Electronics</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3164/5164</td>
<td>Programmable Logic Controllers (PLCs)</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1011</td>
<td>Introduction to Graphic Programs</td>
<td>3</td>
</tr>
<tr>
<td>TECH 1012</td>
<td>ePortfolio Development &amp; Industry Exploration</td>
<td>3</td>
</tr>
<tr>
<td>TECH 2119</td>
<td>Computer Applications in Technology</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3144</td>
<td>Web Publishing</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3150/5150</td>
<td>Graphic Communications Imaging</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3163/5163</td>
<td>Advanced Digital Pre-Media</td>
<td>3</td>
</tr>
<tr>
<td>TECH 4158/5158</td>
<td>Graphic Communications Technical Visualization</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 21

Manufacturing Technology Design Minor

Available to all UNI majors except Manufacturing Technology majors.

Required:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 1017</td>
<td>Computer-Aided Design and Drafting</td>
<td>3</td>
</tr>
<tr>
<td>TECH 1024</td>
<td>Technical Drawing and Design I</td>
<td>3</td>
</tr>
<tr>
<td>TECH 2024</td>
<td>Technical Drawing and Design II</td>
<td>3</td>
</tr>
<tr>
<td>TECH 3024/5024</td>
<td>Advanced CAD and Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours 15
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 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 33 semester hours. A minimum of 15 hours of 200/600-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.

Required core courses:

**Technology Management**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course 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 6225</td>
<td>Integrated Logistics and Production Operations</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6250</td>
<td>Technology of Productivity Improvement</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6258</td>
<td>Total Quality Management</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6275</td>
<td>Advanced Lean Manufacturing</td>
<td>3</td>
</tr>
<tr>
<td>TECH 6295</td>
<td>Advanced Management and Supervision Technology</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 24
Department of Technology

TECH 6300  Advanced Technical Project Management for Engineering and Technology  3

**Choose from one of following options:**  12

<table>
<thead>
<tr>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
</tr>
</tbody>
</table>

**A. Non-Thesis Option**

TECH 6288 (330:288)  Master Internship/Project  3
Supporting approved graduate elective course in Technology.  9
A minimum of 9 graduate credit hours from 5000 or 6000 level courses should be taken in the department of Technology.

**B. Thesis Option**

TECH 6292 (330:292)  Research Methods in Technology  3
TECH 6299 (330:299)  Research (Master's Thesis)  6
PSYCH 6001 (400:239) Advanced Statistics (Or any 5000/6000 statistics course)  3

**Doctor of Industrial Technology Degree Program**

**Admission to this program is currently suspended.**

The Doctor of Industrial Technology (D.I.T.) degree is designed to develop scholars in the fields of education and industry. The University of Northern Iowa offers the D.I.T. degree to meet the increasing need for advanced degree work in the field of Technology, which includes, but is not limited to, technology, applied engineering, trade and industrial education, technical institute education, industrial training, and technology transfer. This research-oriented terminal degree program also includes the study of the technological systems used in industry and their effect on society and culture.

The D.I.T. program emphasizes the development of a thorough knowledge of:

1. Industrial technology as an intellectual discipline,
2. The technological systems used in industry and their effect on people and the environment, and
3. The potential and limitations of future developments in technological systems and their utilization in industry
4. The intellectual tools necessary to pursue scholarly research and applied practices in the field of industrial technology and applied engineering.

The Doctor of Industrial Technology degree program is intended to prepare graduates for one or more of the following professional careers:

1. Faculty, supervisors, and consultants of applied engineering or technology, trade and industrial education, technical institute education and technology education in secondary schools, colleges and universities.
2. Researchers and project coordinators, technology transfer specialists, technology forecasters and assessors of technology for industrial policy planning and decision making.
3. Academic leaders (e.g., deans, department heads, or directors) of technology-oriented programs at postsecondary institutions.
4. Researchers and research coordinators for education and industry in specific content fields of technology.
5. Designers, coordinators and directors of applied/engineering and/or industrial training or human resource programs, and related industrial applications.

The Doctor of Industrial Technology degree program requires a **minimum of 60 semester hours of credit completed beyond the master’s degree**, including a **minimum of 38 hours in 200/6000-level or 300/7000-level course work**. Courses taken for the Master’s degree cannot be repeated for the doctoral degree unless the course description allows it.

It is the student's responsibility to be familiar with all degree program requirements and take the initiative in meeting established guidelines. This information may be obtained from the Graduate Programs Coordinator in the Department of 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. For requirements concerning admission, candidacy, scholarship, residence, examinations, dissertation, and graduation for the Doctor of Industrial Technology refer to www.uni.edu/tech/DIT and the Graduate Information section of this catalog.

The Graduate Record Examination (General Test) is required for admission to the program. The minimum GRE scores for a full admission status must rank as the 30th percentile in verbal, the 30th percentile in analytical writing, and the 50th percentile in quantitative sections.

**Required core:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 6282 (330:282)</td>
<td>Technology Seminar (Three 1 credit hour course)</td>
</tr>
<tr>
<td>TECH 6296</td>
<td>Research Design in Technology</td>
</tr>
<tr>
<td>TECH 7375 (330:375)</td>
<td>Historical and Contemporary Issues in Technology</td>
</tr>
<tr>
<td>TECH 7377 (330:377)</td>
<td>Technology and Societal Trends: Case Studies</td>
</tr>
<tr>
<td>TECH 7378 (330:378)</td>
<td>Technology, Ethics and Leadership</td>
</tr>
<tr>
<td>PSYCH 6001 (400:239) or STAT 3771/5771 (800:121g) or STAT 4777/5777 (800:157g)</td>
<td>Advanced Statistics or Applied Statistical Methods for Research or Statistical Quality Assurance Methods</td>
</tr>
</tbody>
</table>

**Required Technical Elective Courses**

A minimum of 9 credit hours from 6000 or 7000 level courses should be taken in the department of Technology related to the student’s career goals and competencies that are related to the student’s dissertation. Students cannot receive credit for the same courses that they took for the Master’s program.
Supporting Course Work
The supporting course work can be taken from any discipline at the university (including the technology department) as long as it relates to the career goals and competencies. Students cannot receive credit for the same courses that they took for the Master's program.

D.I.T. Internship:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 7388 (330:388)</td>
<td>Doctoral Internship</td>
</tr>
</tbody>
</table>

D.I.T. Dissertation:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 7399 (330:399)</td>
<td>Research (Doctoral Dissertation)</td>
</tr>
</tbody>
</table>

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)

Required:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECH 3065</td>
<td>Technology and Organizational Efficiency</td>
</tr>
<tr>
<td>TECH 3131/5131 (330:131g)</td>
<td>Technical Project Management</td>
</tr>
<tr>
<td>TECH 3142 (330:142)</td>
<td>Statistical Quality Control</td>
</tr>
<tr>
<td>TECH 3143</td>
<td>Managing Operations and Manufacturing Systems</td>
</tr>
<tr>
<td>TECH 3196 (330:196)</td>
<td>Industrial Safety</td>
</tr>
<tr>
<td>TECH 4187/5187 (330:187g)</td>
<td>Applied Industrial Supervision and Management</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.

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. (Spring)

Materials and properties, fundamentals of metal casting, product design considerations, woodworking, 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. Introduction to Graphic Programs — 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 Technologies. (Fall and Spring)

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. (Fall and Spring)

Examination of the resources commonly utilized in the construction industry—money, materials, methods, processes, personnel—and their management. (Fall and Spring)

Evolution and contemporary approaches in technology and engineering education. Examination of career opportunities. (Fall)

Assessment of historical, state-of-the-art communication technologies as tools for exchange of ideas and information. Encompasses digital imaging, printing, publications, wired/wireless communications, technical illustrations, multimedia, and Internet. (Fall and Spring)

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. Prerequisite(s): TECH 1017 (330:017) or pass a CAD Proficiency test. (Fall and Spring)

Analysis of the techniques used in developing construction drawings and reading construction specifications. Computer applications. Prerequisite(s) or corequisite(s): TECH 1018 (330:018). (Variable)

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)
**Department of Technology**

**TECH 1039 (330:039). Circuits and Systems — 3 hrs.**
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)

**TECH 1055 (330:055). Graphic Communications Foundations — 3 hrs.**
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)

**TECH 2024 (330:023). Technical Drawing and Design II — 3 hrs.**
Engineering design process, geometric dimensioning and tolerancing pertaining to ANSI Y14.5M-1994, fasteners, gears, cams, assembly modeling, and rapid prototyping. Prerequisite(s): TECH 1024 (330:024). (Fall and Spring)

**TECH 2036 (330:036). Power Technology — 3 hrs.**
Introduction to energy and mechanical power systems. Lecture and lab cover traditional and emerging electrical power technologies such as renewable energy applications. (Fall)

**TECH 2038 (330:038). Introduction to Electrical Power and Machinery — 3 hrs.**
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, BJT 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)

**TECH 2045 (330:045). Construction Law and Documentation — 3 hrs.**
Examination of construction contract principles, construction documents, and the component parts of law affecting construction operations. Prerequisite(s): TECH 1025 (330:025). (Variable)

**TECH 2060 (330:060). Fundamentals of Automated Manufacturing — 3 hrs.**
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. Prerequisite(s): sophomore standing. (Fall and Spring)

**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 press techniques, variable data implementation, interactive pdf creation, color management and epublishing. Prerequisite(s): TECH 1055 (330:055). (Fall and Spring)

Introductory course of principles and properties of materials, including metals, composites (concrete and asphalt), ceramics, wood, glass, and polymers. Lecture and lab. Prerequisite(s): CHEM 1020 (860:020) or CHEM 1110 (860:044); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); sophomore standing. (Fall and Spring)

**TECH 2080 (330:080). Statics and Strength of Materials — 3 hrs.**
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). (Fall and Spring)

**TECH 2096 (330:096). Construction Safety — 3 hrs.**
OSHA standards (29 CFR Part 1926) for the construction industry. Fall protection, crane utilization, concrete and masonry, steel erection, demolition and scaffolding. Focus on the uniqueness of the construction industry and development of a comprehensive safety and health program. Prerequisite(s): sophomore standing. (Fall)

**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. (Variable)

**TECH 3010. Project Lead The Way: Principles of Engineering — 3 hrs.**
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 (880:011) or PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130). (Fall and Spring)

**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. (Spring)

**TECH 3065. Technology and Organizational Efficiency — 3 hrs.**
This course meets the needs of students who have an interest in real world relationships between organizational efficiency and technological innovations. We will discuss the interrelationships among disciplines and the influence of contemporary technology on the industry, culture, and workplace environment. Prerequisite(s): junior standing. (Fall and Spring)
Philosophy and historical development, principles, practices, and organization of public career and technical and adult education in the nation. Prerequisite(s): junior standing. (Variable)

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 enterprising functions such as financing, designing, producing, and marketing a product. Prerequisite(s): TECH 1008 (330:008); TECH 1017 (330:017) or TECH 1022 (330:022) or TECH 1024 (330:024); or consent of instructor; junior standing. (Fall)

Development of programs and courses for technology and engineering education and related fields, including content decision-making, delivery strategies, and program evaluation. Prerequisite(s): TECH 1019 (330:019); junior standing. (Fall)

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. (Spring)

TECH 3125/5125 (330:125g). Commercial and Heavy/Highway 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): ACCT 2120 (120:030); MGMT 2080 (150:080); TECH 1025 (330:025); junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Spring)

TECH 3126/5126 (330:126g). Land, Route, and Construction Surveying — 3 hrs.
Principles of aerial, boundary, land and route surveying including leveling, area and earthwork volume calculation, photogrammetry, traverse computations, building, culvert, pipeline, municipal street, and highway construction. Design and layout of highway curves. Prerequisite(s): TECH 1018 (330:018); TECH 1025 (330:025); MATH 1420 (800:060); junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (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; PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); Junior Standing or Consent of Instructor. (Odd Springs)

Basic principles of electricity and materials. Methods of electrical system designs in building construction. Prerequisite(s): TECH 2045 (330:045). For Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Fall)

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)

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; 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; 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 1024 (330:024); TECH 2024 (330:023); TECH 3024/5024 (330:122g); junior standing. (Spring)
Department of Technology

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)

Analysis and management of Manufacturing functions. Topics include: forecasting, project management, operations cost analysis, plant layout, process planning, quality control, total quality management, statistical process control, inventory management, materials requirement. 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. (Fall)

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)

Construction cost analysis techniques for estimating materials, labor, equipment, and subcontracting costs in commercial building construction. Prerequisite(s): TECH 1018 (330:018); TECH 1025 (330:025); TECH 2045 (330:045). Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. Corequisite(s): TECH 4124/5124 (330:124g); TECH 3125/5125 (330:125g). (Spring)

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); TECH 3157/5157 (330:157g); junior standing. Corequisite(s): TECH 3129/5129 (330:129g). (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 1055 (330:055); TECH 2070 (330:070); junior standing. (Spring)

TECH 3164/5164 (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): TECH 2038 (330:038); TECH 1039 (330:039); TECH 2041 (330:041); TECH 2042 (330:042); CS 1130 (810:030) or CS 1160 (810:036); junior 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)

TECH 3168/5168 (330:168g). Technology Training Strategies — 3 hrs.
Developing training programs in technological environments, including analysis and utilization of program planning models for business and industry, and specific strategies for customizing training
for various groups within an organization, including synchronous and asynchronous delivery methods. Prerequisite(s): junior standing. (Variable)

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): TECH 3143; MATH 1150 (800:048) or MATH 1420 (800:060); TECH 2072 (330:072); junior standing or consent of instructor. (Odd Falls)

Introduction to lean systems and concepts - basic philosophy of reducing waste in areas such as production, processing, inventory, transportation, waiting time, and scrap generation - to improve quality, reduce cost and production time, and sustainability in manufacturing and product design. 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 3181/5181 (330:181g). Instructional Design for Career and Technical Education — 2 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. (Variable)

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)

Methods of teaching in technology and engineering education and related fields, including group and individualized instructional strategies. Includes 25 hours of field experience. Need minimum grade of C prior to student teaching. Prerequisite(s): TECH 1019 (330:019); junior standing. Prerequisite(s) or corequisite(s): TEACHING 3128. (Spring)

Basic principles of instruction, instructional organization, methods of presentation, lesson planning, and applications of audio-visual media. Prerequisite(s): junior standing. (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)

Basic concepts and techniques for evaluating students and programs in career and technical education. Prerequisite(s): TECH 3181/5181 (330:181g) or consent of department; 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)

Senior group research project pertaining to a topic in construction. Includes an oral and written presentation of the findings, conclusions, and recommendations. Construction Management Students are required to take Associate Constructor (AC) Level 1 - Construction Fundamentals Examination (fee required.) Prerequisite(s): TECH 4154/5154 (330:154g). Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Spring)

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 design for producibility, Design for manufacturing and assembly, Concurrent Engineering. Part design analysis, Tolerance stacking, Process design and development, Operation selection, Manufacturing process selection, Tooling selection, Tolerance charting, Process parameter selection, Cost estimation, Economics of process planning. Prerequisite(s): junior standing. Corequisite(s): TECH 4112. (Fall and Spring)

Basic principles, methods, and equipment pertaining to building mechanical systems (heating, cooling, ventilation, and plumbing) related to human health and comfort. Prerequisite(s): junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Variable)

Advanced course in the principles of metal melting practices with an emphasis on microstructural evolution and thermodynamic reactions. Topics include basic melting practices for ferrous and non-ferrous metals. Processing considerations are covered in relation to developed microstructure and refractory reactions. Prerequisite(s): TECH 2072 (330:072); 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. (Even Falls)

Advanced course in the principles of foundry tooling design including selection of pattern materials, rapid prototype development techniques, gating and riser design, and basic core box production techniques. Prerequisite(s): TECH 2072 (330:072); 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. (Even Springs)

Further development of estimating expertise in previous courses with emphasis on planning, scheduling, and controlling of construction projects based on the use of CPM and Precedence Programming. Assessment of computer-aided scheduling and control systems. Prerequisite(s): TECH 4154/5154 (330:154g); junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Spring)

Utilization of contemporary and emerging building estimating software and advanced estimating techniques. Prerequisite(s): TECH 3149 (330:149); junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Spring)

TECH 4155/5155 (330:155g). Finite Element Analysis — 3 hrs.
Fundamental concepts of the finite element method for linear stress and deformation analysis of mechanical components. Development of truss, beam, frame, plane stress, and plane strain elements. Practical modeling techniques and use of general-purpose codes for solving practical stress analysis problems. Prerequisite(s): TECH 2080 (330:080); MATH 1150 (800:048) or MATH 1420 (800:060); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); junior standing. (Fall)

TECH 4158/5158 (330:158g). Graphic Communications Technical Visualization — 3 hrs.
Development of technical presentations by utilizing digital graphics and technologies for new approaches to visualization; lecture and skills development for creating 2D simulations and animations, data base graphics and charts, and creation of technical presentations. Prerequisite(s): TECH 2119; TECH 2070 (330:070); junior standing. (Fall and Spring)

TECH 4161/5161 (330:161g). Digital Graphic Communications — 3 hrs.
Emphasis on contemporary and future issues in the graphic communications industry. Study of the creation and conversion of graphics for cross-media applications for print and the Internet. Creative problem solving and portfolio development. Prerequisite(s): TECH 2070 (330:070); junior standing. (Fall and Spring)

TECH 4162. Automation - Pneumatics and Hydraulics — 3 hrs.
Basic application of hydraulics and pneumatics towards industrial automation. It includes hydraulic pumps, cylinders, valves, motors, fluid logic control and electrical devices used in fluid control. Pneumatic circuits and applications. Prerequisite(s): MATH 1150 (800:048) or MATH 1420 (800:060); PHYSICS 1511 (880:054) or PHYSICS 1701 (880:130); TECH 2060 (330:060). (Even Falls)

TECH 4165/5165 (330:165g). Wireless Communication Networks — 3 hrs.
Topics include wireless transmission fundamentals, protocols and TCP/IP suites, cellular wireless networks, Mobile IP, wireless LAN technologies, IEEE 802.11 and IEEE 802.15 standards, and security issues in wireless networks. Lecture and lab. Prerequisite(s): TECH 4103/5103 (330:103g) or CS 3470/5470 (810:147g). (Spring)

Theory and industrial applications of solid-state electronic devices for control and conversion of electrical power. Fundamentals of power computations. Analysis/design of power converter circuits and components: single and 3-phase rectifiers, DC-DC, AC/AC converters, and inverters. Prerequisite(s): TECH 2038 (330:038); TECH 3152 (330:152); junior standing. (Fall)

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 4154/5154 (330:154g); junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Spring)
TECH 4174 (330:174). Senior Design I — 1 hr.
Individual and/or team analytical research or design project. Collaboration with local industry, government agencies, or research institutions is encouraged. Must register for TECH 4176 (330:176) in spring semester. Prerequisite(s): TECH 2041 (330:041); TECH 2042 (330:042); TECH 3152 (330:152); TECH 3156 (330:156); ENGLISH 3772/5772; senior in EET major. (Fall)

TECH 4175/5175 (330:175g). Structural Analysis in Construction — 3 hrs.
Structural analysis of wood, concrete, steel, and composite, finite element analysis of structural members. Emphasis on topics such as the design of form work and scaffolding. Prerequisite(s): TECH 2080 (330:080); junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. (Fall)

Development and completion of project identified in TECH 4174 (330:174). Prerequisite(s): TECH 4174 (330:174). (Spring)

Inquiry into recent applications in instructional strategies and content, including research, development, and management of modular technology instructional systems. Prerequisite(s): TECH 1019 (330:019) or consent of instructor; junior standing. (Spring)

Analysis and evaluation of construction improvements, overview of current innovations in construction such as sustainability/LEED/BIM. Prerequisite(s): junior standing. Prerequisite for Construction Management majors: student must have a minimum UNI GPA of 2.20 to take 3000/4000-level construction management courses or student will be dropped. Prerequisite(s) or corequisite(s): TECH 4154/5154 (330:154g). (Fall)

Investigation of industrial supervision and management; includes directed field study in industry. Prerequisite(s): junior standing. (Fall and Spring)

Exploration of workflow systems for cost and pricing associated with the graphic imaging industry and web-to-print publishing. Prerequisite(s): TECH 4093/5093; junior standing. (Spring)

Design of safe and effective facilities for technology and engineering education and related fields, facility management, and development of a safety program. Prerequisite(s): TECH 3120 (330:120) or TECH 3190/5190 (330:190g); junior standing. (Fall)

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

TECH 4210. Manufacturing Senior Projects — 3 hrs.
Cross-disciplinary teams work to research and develop a project with industrial partners. Conception phase includes problem identification, product development and testing, cost analysis, and/or process planning. First semester culminates in project proposal. Prerequisite(s): senior standing; 54 semester hours completed in major technical core and concentration or consent of instructor. Prerequisite(s) or corequisite(s): TECH 4110/5110. (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 (880:011) or PHYSICS 1701 (880:130); junior standing. (Same as PHYSICS 4290/5290) (Spring)

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. (Fall)

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. (Odd Falls)

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 and consent of instructor. (Odd 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. (Variable)

Design and implementation of microcontroller-based embedded computing systems to solve real-world problems. Methodologies,
Department of Technology

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. (Variable)

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. (Even Falls)

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. (Even Springs)

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. (Fall, Spring, Summer)

TECH 6289. Seminar in Engineering and Technology — 1 hr.
Seminar in Engineering and Technology

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)

Overview of technology - its chronological development and evolution. Interrelationships among disciplines and influence of contemporary technology on industry, culture, education, and society. (Even Springs)

Development of knowledge, skills, and advanced application experiences of management technologies utilized in industrial supervision and management. Prerequisite(s): admission to Graduate Program. (Even Springs)

Emphasis on the relationships between theory, planning, research design, instrumentation assessment and administration, data collection and analysis, and the interpretation of findings. Includes critical review of previous research and preparation of proposed manuscripts. Prerequisite(s): graduate status or consent of instructor. (Variable)

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. (Variable)

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)