

# Department of Applied Engineering & Technical Management

(College of Humanities, Arts and Sciences)

<https://chas.uni.edu/aetm>

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

## Undergraduate Majors (B.S.)

- Automation Engineering Technology (p. 1)
- Construction Management (p. 2)
- Electrical Engineering Technology (p. 2)
- Manufacturing Engineering Technology (p. 3)
- Technology and Engineering Education-Teaching (p. 4)

## Undergraduate Majors (B.A.)

- Graphic Technology (p. 4)
- Technology Management (p. 5)

## Minors

- Electrical and Electronics Technology (p. 5)
- Graphic Technology (p. 6)
- Manufacturing Technology Design (p. 6)
- Materials Science and Technology (p. 6) (also listed in Department of Chemistry and Biochemistry and Department of Physics)
- Technology Education - Teaching (p. 7)

## Graduate Major (M.S.)

- Technology (p. 7)

## Program Certificates

- Applied Systems Engineering Management (graduate certificate) (p. 8)
- Technology Management (p. 9)

## Bachelor of Science Degree Programs

### Automation Engineering Technology Major

The B.S. Automation Engineering Technology major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The Automation Engineering Technology program will provide industry-relevant training and hands-on experience for students to

apply automation engineering technology knowledge to industry and manufacturing for process control and system review. Students will be trained on sensors, instrumentations, electrical power, computer programming for controllers, process control, pneumatics and hydraulics, and mechanical systems to solve engineering and technology problems. Students will have a chance to work with industry level state-of-the-art equipment to apply their theoretical knowledge as well as programming industry level controllers to implement Industry 4.0 standards.

### Math and Science

MATH 1150	Calculus for Technology	4
STAT 1772	Introduction to Statistical Methods	3
PHYSICS 1511	General Physics I	4
CS 1160	C/C++ Programming	3
Required AET Major Technical Core		
TECH 1037	Introduction to Circuits	3
TECH 1039	Circuits and Systems	3
TECH 2038	Introduction to Electrical Power and Machinery	3
TECH 2042	Introduction to Digital Electronics	3
TECH 3160/5160	Computer-Aided Instrumentation and Interfacing	3
TECH 3164	Programmable Logic Controllers (PLCs)	3
TECH 1010	Metal Removal Processes	3
TECH 1024	Technical Drawing and Design I	3
TECH 2060	Fundamentals of Automated Manufacturing	3
TECH 2080	Statics and Strength of Materials	3
TECH 3147	Computer Aided Manufacturing	3
TECH 3148	Machine Design	3
TECH 4162	Automation - Pneumatics and Hydraulics	3
TECH 4220 or TECH 4210	Senior Design @ Manufacturing Senior Projects	3
ENGLISH 1005	College Writing and Research	3
ENGLISH 3772/5772	Technical Writing for Engineering Technologists	3
Electives		15
Complete five of the following:		
TECH 2041	Introduction to Analog Electronics *	
TECH 3156	Advanced Digital Electronics	

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TECH 3166/5166	Advanced Electrical Power Systems *	
TECH 3152	Advanced Analog Electronics *	
TECH 4104/5104	Applied Digital Signal Processing *	
TECH 3129/5129	Linear Control Systems *	
TECH 4167/5167	Power Electronics Applications *	
TECH 3157/5157	Microcontroller Applications *	
TECH 4103/5103	Electronic Communications *	
TECH 4165/5165	Wireless Communication Networks *	
TECH 1008	Basic Manufacturing Processes	
TECH 2024	Technical Drawing and Design II	
TECH 2119	Computer Applications in Technology	
TECH 2072	Engineering Materials	
TECH 3113	Manufacturing Tooling *	
TECH 3142	Statistical Quality Control	
TECH 3143	Managing Operations and Manufacturing Systems	
TECH 3196	Industrial Safety	
<b>Total Hours</b>		<b>77</b>

\* These courses have additional prerequisites.

@ This course meets the Bachelor of Science undergraduate research course requirement.

### Construction Management Major

The B.S. Construction Management major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

Required:

Mathematics and Science:		
MATH 1150	Calculus for Technology ^	4
CHEM 1020	Chemical Technology	4
PHYSICS 1511	General Physics I ^	4
STAT 1772	Introduction to Statistical Methods ^	3
ENGLISH 1005	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	Statics and Strength of Materials	3

TECH CM 2100	Mechanical Systems 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, Scheduling and Control	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	Introduction to Business Economics	3
ACCT 2120	Principles of Financial Accounting	3
MGMT 3100	Legal and Social Environment of Business	3
<b>Total Hours</b>		<b>78</b>

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

@ This course meets the Bachelor of Science degree undergraduate research course requirement.

### Electrical Engineering Technology Major

The B.S. Electrical Engineering Technology major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The Electrical Engineering Technology 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](http://www.abet.org).

Required Mathematics and Science core:

Mathematics (take two of the following four courses):			8
MATH 1140	Precalculus		
MATH 1150	Calculus for Technology		
MATH 1420	Calculus I		
MATH 1421	Calculus II		
STAT 1772	Introduction to Statistical Methods	3	
Computer Science:			
CS 1160	C/C++ Programming	3	

Physics:		
PHYSICS 1511	General Physics I	4
PHYSICS 1512	General Physics II	4
Required Technical Core:		
Technology:		
TECH 1037	Introduction to Circuits	3
TECH 1039	Circuits and Systems	3
TECH 2038	Introduction to Electrical Power and Machinery	3
TECH 2041	Introduction to Analog Electronics	3
TECH 2042	Introduction to Digital Electronics	3
TECH 3129/5129	Linear Control Systems	3
TECH 3152	Advanced Analog Electronics	3
TECH 3156	Advanced Digital Electronics	3
TECH 3157/5157	Microcontroller Applications	3
TECH 3160/5160	Computer-Aided Instrumentation and Interfacing	3
TECH 3164	Programmable Logic Controllers (PLCs)	3
TECH 3166/5166	Advanced Electrical Power Systems	3
TECH 4103/5103	Electronic Communications	3
TECH 4104/5104	Applied Digital Signal Processing	3
TECH 4165/5165	Wireless Communication Networks	3
TECH 4167/5167	Power Electronics Applications	3
TECH 4220	Senior Design @	3
Required Technical Writing:		
ENGLISH 1005	College Writing and Research	3
ENGLISH 3772/5772	Technical Writing for Engineering Technologists	3
<b>Total Hours</b>		<b>79</b>

@ This course meets the Bachelor of Science degree undergraduate research course requirement.

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 TECH courses they have not already taken.

### Manufacturing Engineering Technology Major

The B.S. Manufacturing Engineering Technology major requires a minimum of 120 total hours to graduate. This total includes UNIFI/ General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The Manufacturing Engineering Technology Program is accredited by the Engineering Technology Accreditation Commission of ABET, [www.abet.org](http://www.abet.org).

Required Mathematics and Science Core:

Mathematics:		
MATH 1150	Calculus for Technology	4
or MATH 1420	Calculus I	
Chemistry:		
CHEM 1020	Chemical Technology	4
or CHEM 1110	General Chemistry I	
Physics:		
PHYSICS 1511	General Physics I	4
or PHYSICS 1701	Physics I for Science and Engineering	
Required Technical Core:		
Technology:		
TECH 1008	Basic Manufacturing Processes	3
TECH 1010	Metal Removal Processes	3
TECH 1024	Technical Drawing and Design I	3
TECH 2024	Technical Drawing and Design II	3
TECH 2060	Fundamentals of Automated Manufacturing	3
TECH 2072	Engineering Materials	3
TECH 2080	Statics and Strength of Materials	3
TECH 3113	Manufacturing Tooling	3
TECH 3127	Transport Phenomena for Technologists	3
TECH 3142	Statistical Quality Control	3
TECH 3143	Managing Operations and Manufacturing Systems *	3
or TECH 3180	Lean and Sustainable Operations	
TECH 4110/5110	Manufacturing Process Planning	3
TECH 4162	Automation - Pneumatics and Hydraulics	3
TECH 4187	Applied Industrial Supervision and Management	3
TECH 4210	Manufacturing Senior Projects (to be taken in last semester) @	3
English:		
ENGLISH 1005	College Writing and Research	3
ENGLISH 3772/5772	Technical Writing for Engineering Technologists	3
Emphasis: choose one of the following three emphases:		
<b>Total Hours</b>		<b>72</b>

Emphases Options:

<b>Advanced Manufacturing:</b>		
TECH 3024/5024	Solid Modeling and Additive Manufacturing for Design	3
TECH 3147	Computer Aided Manufacturing	3

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TECH 3177	Advanced Manufacturing Processes	3
<b>Manufacturing Design:</b>		
TECH 3024/5024	Solid Modeling and Additive Manufacturing for Design	3
TECH 3135/5135	Product Design	3
TECH 3148	Machine Design	3
<b>Metal Casting:</b>		
TECH 3134	Molding Practices in Metal Casting	3
TECH 4136	Melting Metallurgy and Practices	3
TECH 4137	Tooling Practices in Metal Casting	3

\* Students take TECH 3143 or TECH 3180 with approval of instructor.

@ This course meets the Bachelor of Science degree undergraduate research course requirement.

### Technology and Engineering Education-Teaching Major

The B.S. Technology and Engineering Education-Teaching major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements, the Professional Education Requirements, and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This major leads to Iowa BOEE endorsement #140: 5-12 Industrial Technology.

#### Mathematics/Science Coursework

CHEM 1020	Chemical Technology	4
PHYSICS 1000 & PHYSICS 1010	Physics in Everyday Life and Physics in Everyday Life Laboratory *	4
or PHYSICS 1511	General Physics I	
MATH 1140	Precalculus *	4

#### Technology and Engineering Core

TECH 1008	Basic Manufacturing Processes	3
TECH 1010	Metal Removal Processes	3
TECH 1024	Technical Drawing and Design I	3
TECH CM 1000	Introduction to Construction Processes	3
TECH 1055	Graphic Communications Foundations	3
TECH 1037	Introduction to Circuits	3
or TECH 3164	Programmable Logic Controllers (PLCs)	
TECH TEE 2020	Transportation Technology	3
TECH TEE/PHYSICS 3030	Robotics and Sensors	3

#### Technology and Engineering Education Core:

TECH TEE 1000	Introduction to Technology and Engineering Education	3
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TECH TEE 3100/5100	Technology and Engineering Education Curriculum Planning	3
TECH TEE 3150/5150	Technology & Engineering Education Lab Management	3
TECH TEE 4100	Technology and Engineering Education Level 3 Teaching Experience	1
TECH TEE 4200/5200	Technology and Engineering Education Methods	2
<b>Total Hours</b>		<b>48</b>

\* MATH 1140 prerequisite of satisfactory score on ALEKS exam.  
PHYSICS 1511 prerequisite of MATH 1130 or MATH 1140 or MATH 1420, or equivalent, or a satisfactory ALEKS score.

^ TEACHING 4170/5170 meets the Bachelor of Science degree undergraduate research course requirement.

Note: Students in Technology and Engineering Education--Teaching Major will be waived from LRNTECH 1020 Secondary Educational Technology and Design of the Professional Education Requirements. A student changing majors to a different teaching major would be required to complete LRNTECH 1020 Secondary Educational Technology and Design.

### 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. (accgc.org).

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

#### Required:

TECH 1012	ePortfolio Development & Industry Exploration	3
TECH 1055	Graphic Communications Foundations	3
TECH 2070	Digital Pre-Media	3
TECH 2119	Computer Applications in Technology	3
TECH 3131	Technical Project Management	3
TECH 3144	Web Publishing	3
TECH 3150/5150	Graphic Communications Imaging	3
TECH 3163/5163	Advanced Digital Pre-Media	3
TECH 3169	Digital Imaging	3
TECH 3179	Cooperative Education	3

TECH 4093/5093	Graphic Communications Estimating and Management I	3
TECH 4158/5158	Graphic Communication Data Visualization	3
TECH 4161	Digital Graphic Communications	3
TECH 4187	Applied Industrial Supervision and Management	3
TECH 4193	Graphic Communication Estimating and Management II	3
<b>Total Hours</b>		<b>45</b>

### Technology Management Major

The Technology Management major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

Integrating specific technical background, the Technology Management 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)

STAT 1772	Introduction to Statistical Methods *	3
CHEM 1010 or CHEM 1020 or CHEM 1110	Principles of Chemistry *** Chemical Technology General Chemistry I	4
PHYSICS 1000 or PHYSICS 1511	Physics in Everyday Life *** General Physics I	3-4

#### Management Core:

TECH 2119	Computer Applications in Technology	3
TECH 3065	Technology and Organizational Efficiency	3
TECH 3131	Technical Project Management	3
TECH 3142	Statistical Quality Control	3
TECH 3143	Managing Operations and Manufacturing Systems	3
TECH 3180	Lean and Sustainable Operations	3
TECH 4187	Applied Industrial Supervision and Management	3

#### Technical Electives: \*\* 33

TECH 1008	Basic Manufacturing Processes	
TECH 1010	Metal Removal Processes	
TECH 1011	Software for Graphic Techniques	
TECH 1017	Computer-Aided Design and Drafting	
TECH CM 1000	Introduction to Construction Processes	
TECH 1024	Technical Drawing and Design I	

TECH 1055	Graphic Communications Foundations	
TECH 2036	Power Technology	
TECH 2060	Fundamentals of Automated Manufacturing	
TECH 3102	Living in Our Techno-Social World	
TECH 3114	Product Development and Enterprise	
TECH 3169	Digital Imaging ***	
TECH 3179	Cooperative Education	
TECH 3196	Industrial Safety	
TECH 4000/5000	Wind Energy Engineering	
TECH 4158/5158	Graphic Communication Data Visualization ***	
TECH 4178/5178	Contemporary Instruction in Technology Education	
<b>Total Hours</b>		<b>64-65</b>

\* STAT 1772 has prerequisite of satisfactory score on ALEKS exam or subsequent remediation. Equivalency requires approval by department.

\*\* A minimum of 33 hours of supporting technical courses to be taken from the following or any other courses in the Department of Applied Engineering & Technical Management approved by the students advisor.

\*\*\* CHEM 1110 student must have satisfied university entrance requirements in English and Mathematics; MATH 1120 or MATH 1130 or MATH 1140 or MATH 1150 or MATH 1420 or equivalent, or a satisfactory ALEKS score. PHYSICS 1511 has prerequisite of MATH 1130 or MATH 1140 or MATH 1150 or MATH 1420 or equivalent, or a satisfactory ALEKS score. TECH 3169 has prerequisite of TECH 2070. TECH 4158/5158 has prerequisites of TECH 2119; TECH 2070; junior standing.

### Minors

#### Electrical and Electronics Technology Minor

The Electrical and Electronics Technology 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:		18
TECH 1037	Introduction to Circuits	
TECH 1039	Circuits and Systems	
TECH 2038	Introduction to Electrical Power and Machinery	
TECH 2041	Introduction to Analog Electronics	
TECH 2042	Introduction to Digital Electronics	
TECH 3164	Programmable Logic Controllers (PLCs)	

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Mathematics:		4
MATH 1150	Calculus for Technology	
or MATH 1420	Calculus I	
Computer Science:		3
CS 1130	Visual BASIC Programming	
or CS 1160	C/C++ Programming	
Physics:		4
PHYSICS 1511	General Physics I	
or PHYSICS 1701	Physics I for Science and Engineering	
<b>Total Hours</b>		<b>29</b>

### Graphic Technology Minor

Required:		
Technology:		
TECH 1055	Graphic Communications Foundations	3
TECH 2070	Digital Pre-Media	3
TECH 3169	Digital Imaging	3
TECH 4161	Digital Graphic Communications	3
Electives:		
Technology (select three of the following):		9
TECH 1011	Software for Graphic Techniques	
TECH 1012	ePortfolio Development & Industry Exploration	
TECH 2119	Computer Applications in Technology	
TECH 3144	Web Publishing	
TECH 3150/5150	Graphic Communications Imaging	
TECH 3163/5163	Advanced Digital Pre-Media	
TECH 4158/5158	Graphic Communication Data Visualization	
<b>Total Hours</b>		<b>21</b>

### Manufacturing Technology Design Minor

Available to all UNI majors except Manufacturing Technology majors.

Required:		
Technology:		15
TECH 1017	Computer-Aided Design and Drafting	
TECH 1024	Technical Drawing and Design I	
TECH 2024	Technical Drawing and Design II	
TECH 3024/5024	Solid Modeling and Additive Manufacturing for Design	
TECH 3135/5135	Product Design	
Mathematics and Science:		12
MATH 1150	Calculus for Technology	
or MATH 1420	Calculus I	
CHEM 1020	Chemical Technology	

or CHEM 1110	General Chemistry I	
PHYSICS 1511	General Physics I	
or PHYSICS 1701	Physics I for Science and Engineering	
<b>Total Hours</b>		<b>27</b>

### Materials Science and Technology Minor

This is an interdisciplinary minor that is jointly offered by the Departments of Chemistry and Biochemistry, Physics, and Applied Engineering & Technical Management.

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: <sup>+</sup>** **5-8**

#### Option 1 Chemistry (8 hours)

CHEM 1110	General Chemistry I	
CHEM 1120	General Chemistry II	

#### OR

#### Option 2 Chemistry (5 hours)

CHEM 1130	General Chemistry I-II	
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#### OR

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

CHEM 1020	Chemical Technology &	
TECH 3127	Transport Phenomena for Technologists &	

#### Additional requirements (all three options)

Choose one of the following sets of Physics courses: **8**

PHYSICS 1511	General Physics I	
& PHYSICS 1512	and General Physics II	

#### OR

PHYSICS 1701	Physics I for Science and	
& PHYSICS 1702	Engineering and Physics II for Science and Engineering	

#### Additional required (all three options)

CHEM 4200/5200	Nanoscience <sup>*</sup>	3
or PHYSICS 4200/5200	Nanoscience	

TECH 2072	Engineering Materials	3
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**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.**

CHEM 2110	Descriptive Inorganic Chemistry <sup>*</sup>	
CHEM 2320	Chemical Analysis <sup>#</sup>	
CHEM 4210/5210	Nanotechnology <sup>*</sup>	

or PHYSICS 4210/5210	Technology	
PHYSICS 4750/5750	Physics of Modern Materials #	
TECH 3132/5132	Metallurgy and Phase Transformation	
<b>Total Hours</b>		<b>22-26</b>

+ **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: TECH 1024; MATH 1150 or MATH 1420.

Prerequisite or corequisites for PHYSICS 1701: MATH 1420.

Prerequisite or corequisites for PHYSICS 1702: MATH 1421.

\* Students who have declared a Materials Science and Technology Minor may take these courses after completing CHEM 1020 Chemical Technology and TECH 3127 Transport Phenomena for Technologists in place of the usual CHEM 1120 General Chemistry II prerequisite.

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

# Prerequisite for CHEM 2320: CHEM 1120 or CHEM 1130.  
Prerequisite for PHYSICS 4750/5750:  
PHYSICS 4100/5100 and PHYSICS 4110/5110.

## Technology Education Minor-Teaching

This minor leads to Iowa BOEE endorsement #140: 5-12 Industrial Technology.

Required:

Technology:		
TECH 1008	Basic Manufacturing Processes	3
TECH 1010	Metal Removal Processes	3
TECH 1024	Technical Drawing and Design I	3
TECH CM 1000	Introduction to Construction Processes	3
TECH 1055	Graphic Communications Foundations	3
TECH 1037	Introduction to Circuits	3
TECH TEE 1000	Introduction to Technology and Engineering Education **	3
TECH TEE 2020	Transportation Technology	3
TECH TEE 3030	Robotics and Sensors	3
TECH TEE 3150/5150	Technology & Engineering Education Lab Management	3
TECH TEE 4100	Technology and Engineering Education Level 3 Teaching Experience	1

TECH TEE 4200/5200	Technology and Engineering Education Methods **	2
<b>Total Hours</b>		<b>33</b>

\* TECH TEE 3030 has the following prerequisites: PHYSICS 1511 and PHYSICS 1512, or PHYSICS 1701 and PHYSICS 1702, or TECH 1037 or CS 1510.

\*\* TECH TEE 4200/5200 has prerequisite of TECH TEE 1000 and TEACHING 2017.

\*\*\* TECH 1019 can also be substituted for this course.

## Master of Science Degree Program Major in Technology

The MS Technology program is designed to prepare and develop professionals to perform and function as leaders and skilled technologists in the industrial or educational environments. The program includes four emphases: Technology Management, Information and Electrical Engineering Technology, Metal Casting, and Applied Systems Engineering Management. The curriculum offers both online and face-to-face classes, which are taught by UNI faculty. The program's core courses offer knowledge and skills in research methods, engineering cost analysis, and advanced project management, while the emphasis courses offer in-depth technical contents in specific technology areas. The program promotes a greater depth of understanding of applied technology and management, and technical and professional competency development. It provides opportunities to develop research and application skills directly related to individual competencies, needs, and objectives.

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 Applied Engineering & Technical Management for other application requirements. Graduate information and application for graduate admission can be found at <https://admissions.uni.edu/application>.

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

This degree offers a **thesis and non-thesis option**. The four emphases are the following:

1. Information & Electrical Engineering Technology Emphasis - available in both **thesis** and **non-thesis** options;
2. Metal Casting Emphasis - available in both **thesis** and **non-thesis** options;
3. Technology Management Emphasis - available in both **thesis** and **non-thesis** options;
4. Applied Systems Engineering Management Emphasis - available in **non-thesis** option only.

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 or statistics related content and 6 semester hours of college physics and/or chemistry and biochemistry or other science related content (this may be either graduate or undergraduate credit);

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2. Earned a minimum of 15 semester hours in a major technical field and 8 semester hours in supporting technical subjects;
3. A personal statement;
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 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:

TECH 6100	Engineering Cost Analysis	3
TECH 6300	Advanced Technical Project Management for Engineering and Technology	3
TECH 6292	Research Methods in Technology	3
Any 5000 or 6000 level math content course approved by adviser.		3
Select one of the emphases below (complete emphasis requirements based on choosing thesis or non-thesis option within emphasis).		18
<b>Total Hours</b>		<b>30</b>

### Information and Electrical Engineering Technology Emphasis: Available in thesis and non-thesis options

TECH 4000/5000	Wind Energy Engineering	3
TECH 6242	Complex Digital System Design	3
TECH 6244	Applied Embedded Systems	3
<b>Choose thesis or non-thesis option:</b>		<b>9</b>
<b>Thesis option:</b>		
TECH 6299	Research (Master's Thesis) (- 6 hours)	
electives approved by advisor - 3 hours		
<b>Non-thesis option:</b>		
electives approved by advisor (9 hours)		
<b>Total Hours</b>		<b>18</b>

### Metal Casting Emphasis: Available in thesis and non-thesis options

TECH 6231	Thermodynamics of Material Processing	3
TECH 6235	Material Transformations and Modeling	3

TECH 6239	Foundry Management	3
TECH 6258	Total Quality Management	3
<b>Choose thesis or non-thesis option:</b>		<b>6</b>
<b>Thesis option:</b>		
TECH 6299	Research (Master's Thesis) (6 hours)	
<b>Non-thesis option:</b>		
electives approved by advisor (6 hours)		
<b>Total Hours</b>		<b>18</b>

### Technology Management Emphasis: Available in thesis and non-thesis options

TECH 6258	Total Quality Management	3
TECH 6275	Advanced Lean and Sustainable Operations	3
TECH 6295	Advanced Management and Supervision Technology	3
<b>Choose thesis or non-thesis option:</b>		<b>9</b>
<b>Thesis option:</b>		
TECH 6299	Research (Master's Thesis) (6 hours)	
electives approved by advisor (3 hours)		
<b>Non-thesis option:</b>		
electives approved by advisor (9 hours)		
<b>Total Hours</b>		<b>18</b>

### Applied Systems Engineering Management Emphasis: Available in non-thesis option

TECH 6400	Introduction to Applied Systems Engineering Management	3
TECH 6420	Systems Engineering Architecture	3
TECH 6440	SMART Industrial Development - Systems Simulation	3
TECH 6460	Life Cycle Applications	3
TECH 6500	Systems Engineering Management Capstone Project	6
<b>Total Hours</b>		<b>18</b>

## 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 Applied Engineering & Technical Management or the Office of the Registrar, which serves as the centralized registry.

### Applied Systems Engineering Management Certificate (graduate certificate)

Applied Systems Engineering Management provides a multidisciplinary set of tools and techniques for understanding,



organizing, and managing the complexity of product/service solution development throughout the product life cycle. The program emphasis delivers the necessary skills and knowledge essential for successful systems of systems development in today's fast-paced environment. Students will learn a fundamental and systematic approach for a variety of essential elements, how they interact, how they are dependent upon one another leading to overall best practices. The content reflects an agile and lean approach to system development to meet specific business challenges. Students will learn current industry best practices to ensure robust, cost-effective approaches that meet stringent functional, performance, and cost requirements.

Required:

TECH 6400	Introduction to Applied Systems Engineering Management	3
TECH 6420	Systems Engineering Architecture	3
TECH 6440	SMART Industrial Development - Systems Simulation	3
TECH 6460	Life Cycle Applications	3
TECH 6500	Systems Engineering Management Capstone Project	6
<b>Total Hours</b>		<b>18</b>

### Technology Management Certificate

Required:

STAT 1772	Introduction to Statistical Methods	3
TECH 2119	Computer Applications in Technology	3
TECH 3065	Technology and Organizational Efficiency	3
TECH 3131 or TECH 3143	Technical Project Management Managing Operations and Manufacturing Systems	3
TECH 3142	Statistical Quality Control	3
TECH 4187	Applied Industrial Supervision and Management	3
<b>Total Hours</b>		<b>18</b>

### Automation Engineering Technology, B.S.

Program Educational Objectives (PEOs):

1. Be able to apply Automation Engineering Technology principles with tools to solve industry-related problems
2. Be able to effectively communicate and work independently or in a team environment
3. Be engaged in lifelong learning and professional development
4. Demonstrate high ethical, social, and environmental standards in the conduct of professional activities

Student Learning Outcomes (SLOs):

1. Employ analytical methods to design engineering solutions
2. Apply written, oral, and graphical communication in technical and non-technical environments
3. Conduct experiments to understand and analyze automation processes
4. Collaboratively develop engineering solutions in a team environment

### Construction Management, B.S.

Program Educational Objectives (PEOs):

1. Personal Effectiveness
2. Professionalism & Business Management
3. Technology
4. Means & Methods

Student Learning Outcomes (SLOs):

1. Demonstrate ability to analyze project management techniques within preconstruction, construction and closeout.
2. Evaluate project scope in each of the five basic construction systems (Civil, Structural, Architectural, Mechanical, Electric)
3. Develop a project management plan utilizing appropriate software.
4. Formulate an effective safety plan.
5. Demonstrate ability to communicate the impact of emerging technologies in the construction industry **OR** Demonstrate knowledge of the impact of emerging technologies in the construction industry.

### Electrical Engineering Technology, B.S.

Program Educational Objectives (PEOs):

1. Technical professionals: Development of technical professionals through a comprehensive education and experience in design, manufacture and service of electrical and electronic systems.
2. Applications Based skill sets: Application of engineering concepts and theories into timely, real world solutions for development, building, testing, implementation, operation and maintenance of electrical and electronics systems.
3. Lifelong Learning and Growth: An understanding of the value, and desire for continued lifelong learning both professionally and personally.
4. Professional Behavior: Effective leadership abilities, communication skills and ethical behavior.

Student Learning Outcomes (SLOs):

1. Students will possess problem solving skills involving analysis, design, and simulation, laboratory experimentation with applications to electrical and electronic components, circuits, and systems
2. Students will have an ability to apply programming languages, modern computer tools and techniques to solve applied engineering problems
3. Students will apply linear transform techniques, applied differential equations, and integral calculus to analyze and design control, power, and communication systems

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4. Students will have the ability to design components and systems based on specified requirements and design techniques
5. Students will have an ability to design and carry out experiments and tests, analyze and interpret data to improve processes
6. Students will have knowledge of fundamental principles of science and mathematics and apply them to solve practical problems of engineering technology
7. Students will apply project management techniques to analyze and manage the progress of electrical, electronic system design and development projects, demonstrating project and time management skills
8. Students will produce clear, precise and effective technical documents and oral presentations for both professional and general audience with the help of modern information technologies and use appropriate technical literature
9. Students will collaborate with each other in laboratory and classroom settings to work effectively in teams, and demonstrate leadership on individual and team projects

### Graphic Technology, B.A.

#### Program Educational Objectives (PEOs):

1. Have an understanding of the nature of the graphic communication industry, its organizational structure, socioeconomic principles, and environmental impact.
2. Understanding of the theory and concepts and having a working knowledge of mathematics, data management, and computer technology toward knowledge of the end product.
3. Knowledge of principles and practices for managing material, financial and human resources in the graphic technology industry.
4. Ability to communicate effectively in oral, written, and graphic forms as needed to function as a company team member.
5. Knowledge of industries' workflow

#### Student Learning Outcomes (SLOs):

1. Integrate design and functionality into graphic communications products, optimizing user experience and adoption.
2. Impact production efficiency and product quality across a variety of media by applying knowledge of graphic communications materials, technologies, and practices.
3. Contribute to graphic communications project teams for design, production, and management.
4. Recognize and practice legal and ethical responsibilities concerning the creation, use, and distribution of graphic communications assets or products.
5. Communicate ideas through written, visual, and oral mediums to a wide range of audiences.
6. Research and apply new information to solve graphic communications design, production, and management problems.
7. Apply tools and principles in graphic communications business development and production management.

### Manufacturing Engineering Technology, B.S.

#### Program Educational Objectives (PEOs):

1. Demonstrate an ability to define, formulate, and solve engineering problems through the application of technology with an understanding of the cultural, technical, and environmental effect of decisions.
2. Apply engineering knowledge, critical thinking, and problem solving skills in a collaborative and innovative environment.
3. Continually evolve core knowledge and abilities to emerging technologies through engaging in life-long learning and professional development.
4. Exercise communication and teamwork skills in diverse environments employing high ethical and professional standards.

#### Student Learning Outcomes (SLOs):

1. Interpret data with respect to technical applications
2. Effectively utilize communication tools in supporting engineering solutions
3. Collaborate in a team environment continually learning from each other
4. Apply analytical techniques for engineering solutions
5. Develop engineering solutions that meet requirements

### Technology and Engineering Education Teaching, B.S.

#### Program Educational Objectives (PEOs):

1. Program Educational Objectives reflect both objectives of professional educators (INTASC) and the fields of technology and engineering.

#### Student Learning Objectives (SLOs):

1. Design and deliver curriculum plan in Technology and Engineering Education.
2. Evaluate laboratory spaces in Technology and Engineering Education.
3. Apply skills in Manufacturing as related to Technology and Engineering Education.
4. Apply skills in Construction as related to Technology and Engineering Education.
5. Apply skills in Energy and Power as related to Technology and Engineering Education.
6. Apply skills in Graphic Communications as related to Technology and Engineering Education.
7. Ability to apply skills in Transportation as related to Technology and Engineering Education.

### Technology Management, B.A.

#### Program Educational Objectives (PEOs):

1. Students will obtain a Technology Management Bachelor of Arts degree that focuses on industry, its organization, resources, processes, management, and management technologies.
2. Students of the Technology Management BA program will be able to incorporate an applied approach to critical thinking, communication and problem solving skills, and prepare for

managerial and leadership positions that build upon a strong technical background.

3. Technology Management BA graduates would be able to pursue employment careers in technology management or leadership in industry.

Student Learning Outcomes (SLOs):

1. Communication: Employ effective communication techniques within a management situation.
2. Problem Solving: Solve a technological problem using management principles.
3. Project Management: Develop a plan for appropriate steps to complete a project.
4. Quality: Demonstrate the knowledge of quality management techniques.

### Technology, M.S.

Program Educational Objectives (PEOs):

1. The MS-T program will develop leadership professionals such as managers, supervisors, trainers, and administrators.
2. The MS-T program will enable students to become proficient in performing leadership functions in areas of cost, research and development, and project management operations.
3. Thesis option: The MS-T program will enhance a student's research and development management proficiencies.
4. Non-Thesis option: The MS-T program will enhance a student's practical management proficiencies in an area of technology.

Student Learning Outcomes (SLOs):

1. Written Communication: Compose a technical document using effective communication techniques.
2. Research: Defend a research question by utilizing research analysis techniques.
3. Program content knowledge: Evaluate a technological system based on resources.

### 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)

**TECH CM 2000. Land, Route, and Construction Surveying — 3 hrs.**

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 or MATH 1150. (Fall)

**TECH CM 2050. Construction Law — 3 hrs.**

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

**TECH CM 2100. Mechanical Systems in Construction — 3 hrs.**

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)

**TECH CM 3050. Construction Estimating — 3 hrs.**

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, Scheduling and Control — 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): TECH CM 3050; junior standing. (Fall)

**TECH CM 3250. Computerized Project Management — 3 hrs.**

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; junior standing. (Fall)

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### **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; ENGLISH 3772/5772; senior standing. (Spring)

## Technology Engineering Education Courses

### **TECH TEE 1000. Introduction to 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)

### **TECH TEE 2020. Transportation Technology — 3 hrs.**

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 3030. 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 and PHYSICS 1512, or PHYSICS 1701 and PHYSICS 1702, or TECH 1037 or CS 1510. Other interested students with some experience in coding and/or electronics experience are encouraged to contact the instructor. (Same as PHYSICS 3030) (Variable)

### **TECH TEE 3100/5100. Technology and Engineering Education Curriculum Planning — 3 hrs.**

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; junior standing. (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; junior standing. (Spring)

### **TECH TEE 4100. Technology and Engineering Education Level 3 Teaching Experience — 1 hr.**

Students in the TEE program are required to complete 4 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 BOEE CTE Authorization. Prerequisite(s): TECH TEE 1000; TEACHING 2017; junior standing. (Fall)

### **TECH TEE 4300/5300. Career and Technical Education Methods — 2 hrs.**

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

## Technology Courses

### **TECH 1006. Project Lead The Way: Introduction to Engineering Design — 3 hrs.**

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)

### **TECH 1008. Basic Manufacturing Processes — 3 hrs.**

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)

### **TECH 1010. Metal Removal Processes — 3 hrs.**

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 introduction to CNC machines-advantages applications of CNC machines, introduction to sustainable machining processes. (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)

**TECH 1017. Computer-Aided Design and Drafting — 3 hrs.**

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)

**TECH 1024. Technical Drawing and Design I — 3 hrs.**

Fundamentals of product design process; development of engineering drawings, geometric constructions, sketching, multi-view projections, section views, threaded fasteners, use of 3D CAD techniques for design of parts/components. (Fall and Spring)

**TECH 1037. 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)

**TECH 1039. 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. Prerequisite(s) or corequisite(s): MATH 1140. Automation Engineering Technology majors will be waived from MATH 1140. (Spring)

**TECH 1055. 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)

**TECH 2024. Technical Drawing and Design II — 3 hrs.**

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. (Spring)

**TECH 2036. 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. (Variable)

**TECH 2038. 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; TECH 1039; MATH 1150 or MATH 1420. (Fall)

**TECH 2041. 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; TECH 1039; MATH 1140. (Fall)

**TECH 2042. 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): For Non-Automation Engineering Technology majors: TECH 1037; TECH 1039; MATH 1140. Prerequisite(s) for Automation Engineering Technology majors: MATH 1140 or MATH 1150; TECH 1037; TECH 1039. (Fall)

**TECH 2060. 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. 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. 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 e-publishing. Prerequisite(s): TECH 1055. (Spring)

**TECH 2072. Engineering Materials — 3 hrs.**

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 UNIFI Written Communication requirement; CHEM 1020 or CHEM 1110; PHYSICS 1511 or PHYSICS 1701; sophomore standing. (Spring)

**TECH 2080. 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 or PHYSICS 1701; MATH 1150 or MATH 1420. (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)

**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 or PHYSICS 1511 or PHYSICS 1701. (Variable)

**TECH 3024/5024. Solid Modeling and Additive Manufacturing for Design — 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. Concepts of design for additive manufacturing (AM) introduced at the solid

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modeling stage for subsequent use in group projects. Students work in collaborative group projects for developing a product (parts and assembly), preparing for AM (3D printing/prototyping the product). Lecture and lab. Prerequisite(s): TECH 1024; TECH 2024; junior standing. (Fall)

### **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. (Spring)

### **TECH 3102. Living in Our Techno-Social World — 3 hrs.**

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) (Spring)

### **TECH 3113. Manufacturing Tooling — 3 hrs.**

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; TECH 1010; TECH 1024; MATH 1150 or MATH 1420; CHEM 1020 OR CHEM 1110; PHYSICS 1511 or PHYSICS 1701; TECH 2072; junior standing. (Spring)

### **TECH 3114. Product Development and Enterprise — 3 hrs.**

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; TECH 1017 or TECH 1022 or TECH 1024; or consent of instructor; junior standing. (Variable)

### **TECH 3121/5121. Applied Technology Systems — 3 hrs.**

Applications and analysis of technology systems. Also includes equipment operation, maintenance, and safety. Prerequisite(s): TECH 1010; TECH 1024; junior standing. Students with AAS degree will be evaluated individually by department. (Variable)

### **TECH 3127. Transport Phenomena for Technologists — 3 hrs.**

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; MATH 1150 or MATH 1420; CHEM 1020 or CHEM 1110; PHYSICS 1511 or PHYSICS 1701; junior standing or consent of instructor. (Spring)

### **TECH 3129/5129. 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; PHYSICS 1511 or PHYSICS 1701; junior standing. (Fall)

### **TECH 3131. 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. (Spring)

### **TECH 3132/5132. Metallurgy and Phase Transformation — 3 hrs.**

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 or CHEM 1110; PHYSICS 1511 or PHYSICS 1701; or consent of instructor; junior standing. (Variable)

### **TECH 3134. Molding Practices in Metal Casting — 3 hrs.**

Study of molding practices used in contemporary metal casting. Prerequisite(s): TECH 2072; CHEM 1020 or CHEM 1110; PHYSICS 1511 or PHYSICS 1701; junior standing or consent of instructor. (Odd Falls)

### **TECH 3135/5135. Product Design — 3 hrs.**

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; junior standing. (Spring)

### **TECH 3142. Statistical Quality Control — 3 hrs.**

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 or MATH 1150 or MATH 1420 or STAT 1772; junior standing or consent of instructor. (Fall and Spring)

### **TECH 3143. Managing Operations and Manufacturing Systems — 3 hrs.**

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 or MATH 1150 or MATH 1420 or STAT 1772; junior standing or consent of instructor. (Fall and Spring)

### **TECH 3144. Web Publishing — 3 hrs.**

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)

### **TECH 3147. Computer Aided Manufacturing — 3 hrs.**

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. Robot programming using simulation software. Prerequisite(s): TECH 1010; TECH 1024; TECH 2060; junior standing or consent of instructor. (Odd Springs)

### **TECH 3148. Machine Design — 3 hrs.**

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 or MATH 1420; PHYSICS 1511 or PHYSICS 1701; TECH 2080; Junior Standing or Consent of Instructor. (Fall)

**TECH 3150/5150. 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; junior standing. (Spring)

**TECH 3152. Advanced Analog Electronics — 3 hrs.**  
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; TECH 1039; TECH 2041. Prerequisite(s) or corequisite(s): MATH 1150 or MATH 1420; sophomore standing. (Spring)

**TECH 3156. Advanced Digital Electronics — 3 hrs.**  
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; TECH 1039; TECH 2042 or CS 1410; sophomore standing. (Spring)

**TECH 3157/5157. Microcontroller Applications — 3 hrs.**  
Microcontroller technology applied to real-time industrial problems; survey of industrial computer hardware, networking, and software. Lecture and lab. Prerequisite(s): TECH 3152; TECH 3156; CS 1160 or consent of instructor; junior standing. (Fall)

**TECH 3160/5160. Computer-Aided Instrumentation and Interfacing — 3 hrs.**  
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 2042; junior standing. (Spring)

**TECH 3163/5163. Advanced Digital Pre-Media — 3 hrs.**  
An advanced look into 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 publishing. Prerequisite(s): TECH 2070; junior standing. (Fall)

**TECH 3164. 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)

**TECH 3166/5166. Advanced Electrical Power Systems — 3 hrs.**  
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; MATH 1150 or MATH 1420; PHYSICS 1511 or PHYSICS 1701; junior standing. (Spring)

**TECH 3169. Digital Imaging — 3 hrs.**  
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. (Fall)

**TECH 3177. Advanced Manufacturing Processes — 3 hrs.**  
Engineering analysis of different shaping processes; Non-traditional machining processes, Additive manufacturing, 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, introduction to smart manufacturing (Industry 4.0). Prerequisite(s): PHYSICS 1511 or PHYSICS 1701; MATH 1150 or MATH 1420; TECH 1008; TECH 1010; TECH 1024; TECH 2060; junior standing. (Odd Falls)

**TECH 3180. Lean and Sustainable Operations — 3 hrs.**  
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): MATH 1150 or MATH 1420 or STAT 1772; junior standing or consent of instructor. (Spring)

**TECH 3182/5182. 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)

**TECH 3183. Fundamentals of Manufacturing Engineering — 3 hrs.**  
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)

**TECH 3192/5192. Non-Destructive Evaluation of Materials/ Scanning Electron Microscopy — 3 hrs.**  
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 or TECH 3132/5132; junior standing. (Variable)

**TECH 3196. Industrial Safety — 3 hrs.**  
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; TECH 2119; junior standing. (Fall)

**TECH 4103/5103. 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; TECH 3156; MATH 1150 or MATH 1420; junior standing. (Fall)

**TECH 4104/5104. Applied Digital Signal Processing — 3 hrs.**

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 or CS 1410; CS 1160 or CS 1130; junior standing. (Spring)

**TECH 4110/5110. Manufacturing Process Planning — 3 hrs.**

This course deals with the best practices used in industry to design and manufacture successful products. Product cycle in manufacturing, product quality, part design for producibility, 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): CHEM 1020 or CHEM 1110 ; PHYSICS 1511 or PHYSICS 1701; MATH 1150 or MATH 1420; TECH 1008; TECH 1010; TECH 2024; TECH 2060; TECH 2072; ENGLISH 3772/5772 (undergraduates) or ENGLISH 5772 (graduates); junior standing. (Fall)

**TECH 4136. Melting Metallurgy and Practices — 3 hrs.**

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; MATH 1150 or MATH 1420; CHEM 1020 or CHEM 1110; PHYSICS 1511 or PHYSICS 1701; junior standing or consent of instructor. (Even Falls)

**TECH 4137. Tooling Practices in Metal Casting — 3 hrs.**

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; MATH 1150 or MATH 1420; CHEM 1020 or CHEM 1110; PHYSICS 1511 or PHYSICS 1701; junior standing or consent of instructor. (Even Springs)

**TECH 4155/5155. 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; MATH 1150 or MATH 1420; PHYSICS 1511 or PHYSICS 1701; junior standing. (Variable)

**TECH 4158/5158. Graphic Communication Data Visualization — 3 hrs.**

Development of data visualizations based on best practices for layout and communication, utilizing digital graphics techniques and current technologies. Analyzing and manipulating databases to prepare and execute variable data output. Lecture and skills development for creating data-based graphics, charts, and technical presentations. Prerequisite(s): TECH 2070; TECH 2119; junior

standing. TECH 2119 is waived for non-Graphic Technology majors. (Fall)

**TECH 4161. 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; junior standing. (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. Robotics, safety, structured programming, I/O instructions, material handling operations, robot calibration. Prerequisite(s): MATH 1150 or MATH 1420; PHYSICS 1511 or PHYSICS 1701; TECH 2060. (Fall)

**TECH 4165/5165. 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): junior standing. Prerequisite(s) or corequisite(s): TECH 4103/5103 or CS 3470/5470. (Fall)

**TECH 4167/5167. Power Electronics Applications — 3 hrs.**

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 3152; junior standing. Prerequisite(s) or corequisite(s): TECH 2038. (Spring)

**TECH 4178/5178. Contemporary Instruction in Technology Education — 3 hrs.**

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

**TECH 4184/5184. Digital Imaging II — 3 hrs.**

Students will explore digital imaging formats in a lab-based, hands-on environment. Topics include color calibration and printing large format images, as well as workflow and production issues, color pre-press and digital formats appropriate to multiple media. Prerequisite(s): TECH 3169; junior standing. (Spring)

**TECH 4187. Applied Industrial Supervision and Management — 3 hrs.**

Application of day-to-day planning, organizing, staffing, leading, and controlling of people, goods and services. Topics include problem solving, leadership, teamwork, coaching and communication, training, safety, ethics, equal opportunity employment, stakeholder engagement, and best practices of supervision and management. Prerequisite(s): junior standing. (Fall and Spring)

**TECH 4193. Graphic Communication Estimating and Management II — 3 hrs.**

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)

**TECH 4198. 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. 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)

**TECH 4220. Senior Design — 3 hrs.**

Senior Design represents the practical execution of the technological skills, theory and knowledge students have gained from all sources through their college career. This course is a capstone experience, which requires both teamwork and individual skills in solving a modern industrial problem. The purpose of the senior design course is to bridge the gap between academic theory and real world practice by continuing learning. Students will be introduced to the ethical responsibilities of design and the impact of engineering solutions on society. Individual and/or team projects. Collaboration with local industry, government agencies, or research institutions is encouraged. Prerequisite(s): declared Electrical Engineering Technology (EET) major; completion of at least six EET major courses; senior standing or consent of instructor. Prerequisite(s) or corequisite(s): ENGLISH 3772/5772. (Spring)

**TECH 4290/5290. Project Lead The Way: Digital Electronics — 3 hrs.**

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 or PHYSICS 1400 or PHYSICS 1701; junior standing. (Same as PHYSICS 4290/5290) (Variable)

**TECH 6100. Engineering Cost Analysis — 3 hrs.**

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): Admitted to the MS Technology Program OR Instructor Consent. (Odd Falls)

**TECH 6225. Integrated Logistics and Production Operations — 3 hrs.**

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): Admitted to the MS Technology Program OR Instructor Consent. (Variable)

**TECH 6231. Thermodynamics of Material Processing — 3 hrs.**

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): Admitted to the MS Technology Program/Metal Casting Emphasis OR Instructor Consent. (Odd Falls)

**TECH 6235. Material Transformations and Modeling — 3 hrs.**

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): Admitted to the MS Technology Program/Metal Casting Emphasis OR Instructor Consent. (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): Admitted to the MS Technology Program/Metal Casting Emphasis OR Instructor Consent. (Even Springs)

**TECH 6242. Complex Digital System Design — 3 hrs.**

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): Admitted to the MS Technology Program OR Instructor Consent. (Odd Springs)

**TECH 6244. Applied Embedded Systems — 3 hrs.**

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): Admitted to the MS Technology Program OR Instructor Consent. (Even Falls)

**TECH 6250. 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): Admitted to the MS Technology Program OR Instructor Consent. (Variable)

**TECH 6258. Total Quality Management — 3 hrs.**

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): Admitted to the MS Technology Program OR Instructor Consent. (Odd Springs)

**TECH 6275. Advanced Lean and Sustainable Operations — 3 hrs.**

Skills and techniques in Lean principles applied to manufacturing and service industries: Lean enterprises, process development, supply networks, JIT tools - SMED, Kaisen, 5S, Poka-yoke, value stream mapping, time studies, motion studies, ergonomics, sustainability, sustainable operations, and carbon footprint calculations. Prerequisite(s): Admitted to the MS Technology Program OR Instructor Consent. (Odd Falls)

**TECH 6282. 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. 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

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should not take this course during their first semester. Prerequisite(s): Admitted to the MS Technology Program OR Instructor Consent. (Variable)

### **TECH 6292. Research Methods in Technology — 3 hrs.**

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). Prerequisite(s): Admitted to the MS Technology Program OR Instructor Consent. (Spring)

### **TECH 6295. Advanced Management and Supervision Technology — 3 hrs.**

Development of knowledge, skills, and advanced application experiences of management technologies utilized in industrial supervision and management. Prerequisite(s): Admitted to the MS Technology Program OR Instructor Consent. (Even Falls)

### **TECH 6299. Research (Master's Thesis).**

Prerequisite(s): Admitted to the MS Technology Program OR Instructor Consent. (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): Admitted to the MS Technology Program OR Instructor Consent. (Odd Springs)

### **TECH 6400. Introduction to Applied Systems Engineering Management — 3 hrs.**

This course presents the foundations of operational analysis, systems engineering architecture, systems engineering, and project management, in an integrated format. Through a synchronized combination of in-class lectures, industrial guest speakers, and individual and team assignments, this course provides an overall perspective for corporate decision making using a systems of systems approach. Prerequisite(s): consent of department. (Fall)

### **TECH 6420. Systems Engineering Architecture — 3 hrs.**

Systems Engineering Architecture combines the structure of all engineering systems, elements and the tactical insights of operational planning to deliver a specific capability, element or product. This course takes an analytical and data-driven approach to decompose and analyze the constituent parts of a mission in order to identify measurable trade-offs and draw conclusions. Prerequisite(s): TECH 6400. (Fall)

### **TECH 6440. SMART Industrial Development - Systems Simulation — 3 hrs.**

As systems/products/processes grow increasingly complex to meet the demands of the contemporary global market, companies are challenged to consistently deliver high-quality products under tighter and tighter budgets and schedules. This SMART Development course provides a multidisciplinary set of tools and techniques for understanding, organizing, and managing the complexity of product

development throughout the product life cycle. This course brings together current industry best practices to ensure robust, cost-effective approaches that meet stringent functional, performance, and cost requirements. Prerequisite(s): TECH 6400. (Spring)

### **TECH 6460. Life Cycle Applications — 3 hrs.**

This course provides a comprehensive overview of the applied solution design and management system acquisition life-cycle management, technical and business processes. The course also presents the program management integration process that ties them all together. The course goal is to immerse the students in applied system design management, acquaint them with the specialized terminology, familiarize them with the roles of the primary life cycle stakeholders and demonstrate how it all fits together. Prerequisite(s): TECH 6400. (Spring)

### **TECH 6500. Systems Engineering Management Capstone Project — 6 hrs.**

This course applies knowledge from the previous courses in the Applied Systems Engineering Management program to a live corporate issue. Prerequisite(s): TECH 6400; TECH 6420; TECH 6440; TECH 6460. (Summer)

### **TECH 7300. DIT Post Comprehensive Registration.**

(Fall and Spring)

### **TECH 7386. Studies in Microgrids in Electrical Power Systems — 3 hrs.**

Studies in Microgrids in Electrical Power Systems

### **TECH 7388. Doctoral Internship — 3-6 hrs.**

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)

### **TECH 7399. Research (Doctoral Dissertation).**

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