

# INDUSTRIAL TECHNOLOGY

The Department of Agricultural and Biosystems Engineering offers a bachelor of science degree in Industrial Technology (ITEC), as well as an undergraduate certificate in Occupational Safety. Students majoring in ITEC choose between three options: Biological and Biomanufacturing Systems Technology, Manufacturing or Occupational Safety. The department also offers a minor in Industrial Technology.

Successful ITEC graduates gain knowledge, skills, and abilities in solving technical problems, understanding the design process, excelling in authentic leadership, being aware of safety issues, having a quality orientation, effectively managing projects, and having a systems-thinking perspective. This translates to a holistic approach that uses science and engineering principles to focus on the way the constituent parts of a manufacturing system interrelate, how they work over time, and how they fit the context of larger systems. Graduates find careers within a variety of industries, businesses, and organizations in the fields of advanced manufacturing and biomanufacturing; robotics; analytical and processing laboratories; automation and controls; biofuel and beverage fermentation systems electronics; lean manufacturing; quality and operations management; safety management, loss prevention; or industrial hygiene.

Common job duties of ITEC Biological and Biomanufacturing Systems Technology graduates include:

- Implementation, management, and documentation of analytical protocols
- Technical project management
- Implement, manage, and maintain instrumentation and equipment
- Manage bioprocessing and biotechnology systems

Common job duties of ITEC Manufacturing graduates include:

- Quality management
- Production supervision
- Product process design
- Facility planning and management

Common job duties of ITEC Occupational Safety graduates include:

- Development, management, and evaluation of safety programs and systems
- Hazard identification and mitigation
- Loss prevention

The certificate in occupational safety is designed to meet the needs of the students who will find themselves in management roles with responsibilities that include safety. The certificate program prepares

technically-oriented managers to meet their professional safety responsibilities.

For more information about the Industrial Technology degree: <http://www.abe.iastate.edu/undergraduate-students/industrial-technology/>

For more information about the occupational safety certificate: <http://www.abe.iastate.edu/home/certificate-in-occupational-safety/>

## Student Learning Outcomes

Upon graduation, all ITEC students should be able to:

1. Apply knowledge of mathematics, science, computation, and applied engineering to identify and solve applied science and technology problems
2. Develop and conduct experiments, and analyze and interpret resulting data
3. Evaluate and adapt systems, processes and programs to meet desired needs
4. Function effectively on multi-disciplinary teams
5. Communicate effectively, ethically, and professionally in written, oral, and other formats to technical and non-technical audiences
6. Understand the potential impacts and limitations of solutions in global and societal contexts
7. Recognize the need for, and demonstrate an ability to, engage in life-long learning
8. Effectively apply modern scientific and technical tools necessary for professional practice to address contemporary issues in applied engineering and technology

Upon graduation, ITEC students in the biological and biomanufacturing systems technology (BBST) option should be able to:

1. Develop, implement, troubleshoot, and evaluate bio-based manufacturing processes, facilities, and products
2. Calculate and interpret mass and energy balances of biological processes involving microbial growth and conversion, plants, animals, and humans to optimize processing and production systems
3. Calculate and interpret rates of biological processes involving reaction kinetics, growth, death, heat production, and transpiration to optimize processing and production systems.

Upon graduation, ITEC students in the manufacturing (M) option should be able to:

1. Create, implement, and evaluate manufacturing processes and facility plans
2. Integrate and apply tools in computer aided design, manufacturing, controls, robotics, and automation systems to applied engineering and technology management settings

- Evaluate technologies to enhance production, quality, sustainability, and profitability of manufacturing systems and facility management

Upon graduation, ITEC students in the occupational safety (OS) option should be able to:

- Design, implement, and evaluate occupational safety and health programs for work environments
- Identify, assess, and analyze hazards and loss-producing conditions in work environments
- Eliminate or control occupational hazards using appropriate technologies, training, and administrative interventions

Total Degree Requirement: 120 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

**Communications Proficiency:**

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

**Communication/Library: 13 cr.**

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Introduction to College Level Research	1
One of the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
AGEDS 327	Survey of Agriculture and Life Sciences Communication	
One of the following:		3
SP CM 212	Fundamentals of Public Speaking	
COMST 214	Professional Communication	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
<b>Total Credits</b>		<b>13</b>

**Mathematical, Physical, and Life Sciences: 25 cr.**

STAT 104	Introduction to Statistics	3
MATH 145	Applied Trigonometry	3
MATH 151	Calculus for Business and Social Sciences	3
PHYS 131	General Physics I	4
PHYS 131L	General Physics I Laboratory	1
CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
One of the following:		3

BIOL 101	Introductory Biology	
BIOL 211	Principles of Biology I	
BIOL 212	Principles of Biology II	
BIOL 251	Biological Processes in the Environment	
Second Biology course requirement by Option:		3
Manufacturing option		
Life Sciences Elective from approved College of Agriculture and Life Sciences list		
Occupational Safety option		
BIOL 255	Fundamentals of Human Anatomy	
<b>Total Credits</b>		<b>25</b>

**Business, Humanities, Ethics, and Social Sciences: 18 cr.**

Occupational safety option must take ACCT 215

ACCT 284	Financial Accounting	3
or ACCT 215	Legal Environment of Business	
ECON 101	Principles of Microeconomics	3
TSM 370	Occupational Safety (Ethics)	3
Humanities course from College of Agriculture and Life Sciences list		3
International Perspectives course from University list		3
U.S. Diversity course from University list		3
<b>Total Credits</b>		<b>18</b>

**Technical Core: 28 cr.**

TSM 110	Introduction to Technology	1
TSM 111	Experiencing Technology	1
TSM 115	Solving Technology Problems	3
TSM 116	Introduction to Design in Technology	3
TSM 201	Preparing for Workplace Seminar	1
TSM 210	Fundamentals of Technology	3
TSM 214	Managing Technology Projects	1
TSM 270	Principles of Injury Prevention and Safety	3
TSM 310	Total Quality Improvement	3
TSM 363	Electrical Power and Control Systems for Agriculture and Industry	4
TSM 397	Summer Internship in Technology	R
or TSM 399	Internship in Technology	
TSM 415	Applied Project Management in Technology	2
TSM 416	Technology Capstone	3
<b>Total Credits</b>		<b>28</b>

**TSM 397 or TSM 399 may count toward graduation.****Manufacturing Option: 36 cr.**

One of the following: 1

A B E 271	Engineering Applications of Parametric Solid Modeling	1
A B E 272	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	1
A B E 273	CAD for Process Facilities and Land Use Planning	1
TSM 216	Advanced Technical Graphics, Interpretation, and CAD	2
TSM 240	Introduction to Advanced Manufacturing and Metals Processing	3
TSM 241	Introduction to Manufacturing Processes for Plastics	2
TSM 337	Fluid Power Systems Technology	3
TSM 340	Advanced Automated Manufacturing Processes	3
TSM 440	Cellular Lean Manufacturing Systems	3
TSM 443	Statics and Strength of Materials for Technology	3
TSM 444	Facility Planning	3
TSM 449	Applied Nondestructive Testing and Evaluation.	3
TSM 465	Automation Systems	3
7 credits of free electives		7
<b>Total Credits</b>		<b>36</b>

**Occupational Safety Option: 36 cr.**

TSM 240	Introduction to Advanced Manufacturing and Metals Processing	3
TSM 371	Occupational Safety Management	2
TSM 372	Legal Aspects of Occupational Safety and Health	2
TSM 376	Fire Protection and Prevention	3
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
TSM 471	Safety Laboratory	1
TSM 477	Risk Analysis and Management	3
H S 105	First Aid and Emergency Care	2
PSYCH 250	Psychology of the Workplace	3
14 credits of free electives		14
<b>Total Credits</b>		<b>36</b>

**Biological and Biomanufacturing Systems Technology Option: 36 cr.**

BIOL 212	Principles of Biology II	3
CHEM 211	Quantitative and Environmental Analysis	2
CHEM 211L	Quantitative and Environmental Analysis Laboratory	2
LD ST 322	Leadership in a Diverse Society	3

MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
TSM 380	Fundamentals, Applications, and Modeling of Biological Systems	3
Select 15 credits from departmental list		15
5 credits of free electives		5
<b>Total Credits</b>		<b>36</b>

**Industrial Technology, B.S. - manufacturing option****First Year**

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3
ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 131	4
MATH 145	3	PHYS 131L	1
CHEM 163	4	ECON 101	3
CHEM 163L	1		
		<b>16</b>	<b>15</b>

**Second Year**

Fall	Credits	Spring	Credits
TSM 201	1	TSM 216	2
TSM 210	3	TSM 241	2
TSM 214	1	STAT 104	3
TSM 240	3	BIOL 101 or 211	3
TSM 270	3	International Perspectives - See list*	3
ENGL 250	3	SP CM 212, COMST 214, or AGEDS 311	3
		<b>14</b>	<b>16</b>

**Third Year**

Fall	Credits	Spring	Credits	Summer	Credits
TSM 340	3	TSM 310	3	TSM 397 or 399	R
TSM 363	4	TSM 337	3		
ACCT 284 or 215	3	TSM 370 (Ethics requirement)	3		

US Diversity - See list*	3 A B E 271, 272, or 273	1	
ENGL 302, 309, 314, or AGEDS 327	3 Humanities - See list*	3	
	Life Science - See list*	3	
<hr/>		<b>16</b>	<b>16</b>

**Fourth Year**

Fall	Credits	Spring	Credits
TSM 415	2	TSM 416	3
TSM 440	3	TSM 444	3
TSM 443	3	TSM 465	3
TSM 449	3	Elective	4
Elective	3		
<hr/>		<b>14</b>	<b>13</b>

\* International Perspectives course list (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)  
 US Diversity course list (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)  
 Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)  
 Life Science course list (<https://www.cals.iastate.edu/student-services/life-science/>)

**Industrial Technology, B.S. - occupational safety option**

**First Year**

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3
ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 131	4
MATH 145	3	PHYS 131L	1
CHEM 163	4	ECON 101	3
CHEM 163L	1		
<hr/>		<b>16</b>	<b>15</b>

**Second Year**

Fall	Credits	Spring	Credits
TSM 201	1	TSM 240	3
TSM 214	1	TSM 371	2
TSM 210	3	H S 105	2

TSM 270	3	STAT 104	3
ENGL 250	3	SP CM 212, COMST 214, or AGEDS 311	3
BIOL 251	3	BIOL 255	3
<hr/>		<b>14</b>	<b>16</b>

**Third Year**

Fall	Credits	Spring	Credits	Summer	Credits
TSM 363	4	TSM 310	3	TSM 397 or 399	R
TSM 372	2	TSM 370	3		
TSM 376	3	TSM 471	1		
ENGL 302, 309, 314, or AGEDS 327	3	TSM 470	3		
Elective	3	ACCT 215	3		
		International Perspectives*	3		
<hr/>		<b>15</b>	<b>16</b>	<b>0</b>	

**Fourth Year**

Fall	Credits	Spring	Credits
TSM 415	2	TSM 416	3
TSM 477	3	US Diversity*	3
PSYCH 250	3	Humanities*	3
Elective	6	Elective	5
<hr/>		<b>14</b>	<b>14</b>

\* International Perspectives course list (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)  
 U.S. Diversity course list (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)  
 Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)  
 Life Science course list (<https://www.cals.iastate.edu/student-services/life-science/>)

**Industrial Technology, B.S. - biological and biomanufacturing systems technology option**

**First Year**

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3

ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 131	4
MATH 145	3	PHYS 131L	1
CHEM 163	4	ECON 101	3
CHEM 163L	1		

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**16**                      **15**

**Second Year**

Fall	Credits	Spring	Credits
TSM 201		1 CHEM 211	2
TSM 214		1 CHEM 211L	2
TSM 210		3 STAT 104	3
BIOL 211		3 BIOL 212	3
TSM 270		3 LD ST 322	3
ENGL 250		3	

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**14**                      **13**

**Third Year**

Fall	Credits	Spring	Credits	Summer	Credits
TSM 310		3 TSM 380		3 TSM 397 or 399	R
TSM 363		4 MICRO 201		2	
ACCT 284 or 215		3 MICRO 201L		1	
Speech Communication - See list*		3 TSM 370 (Ethics requirement)		3	
Option core course - See list*		3 Humanities - See list*		3	
		International Perspectives - See list*		3	

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**16**                      **15**                      **0**

**Fourth Year**

Fall	Credits	Spring	Credits
Option core course - See list*		3 TSM 416	3
TSM 415		2 Advanced English - See list*	3
Option core course - See list*		3 Option core course - See list*	3

Option core course - See list*	3	Option core course - See list*	3
Elective	4	Elective	4
	<b>15</b>		<b>16</b>

\* International Perspectives course list (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)  
 U.S. Diversity course list (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)  
 Humanities course list (<https://www.cals.iastate.edu/student-services/humanities/>)  
 Option core course list (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofagricultureandlifesciences/industrialtechnology/#curriculumtext>)

## Minor - Industrial Technology

The Department of Agricultural and Biosystems Engineering offers a minor in industrial technology which may be earned by completing a minimum of 15 credits of technology systems management (TSM) courses, which includes:

TSM 115	Solving Technology Problems	3
TSM 210	Fundamentals of Technology	3
9 credits from:		9
TSM 216	Advanced Technical Graphics, Interpretation, and CAD	
TSM 240	Introduction to Advanced Manufacturing and Metals Processing	
TSM 241	Introduction to Manufacturing Processes for Plastics	
TSM 270	Principles of Injury Prevention and Safety	
TSM 310	Total Quality Improvement	
TSM 337	Fluid Power Systems Technology	
TSM 340	Advanced Automated Manufacturing Processes	
TSM 363	Electrical Power and Control Systems for Agriculture and Industry	
TSM 370	Occupational Safety	
TSM 371	Occupational Safety Management	
TSM 372	Legal Aspects of Occupational Safety and Health	
TSM 376	Fire Protection and Prevention	
TSM 440	Cellular Lean Manufacturing Systems	
TSM 443	Statics and Strength of Materials for Technology	
TSM 444	Facility Planning	

TSM 449	Applied Nondestructive Testing and Evaluation.	
TSM 465	Automation Systems	
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	
TSM 471	Safety Laboratory	
TSM 477	Risk Analysis and Management	
• At least six (6) credits of 300-level or higher TSM classes (from the courses listed above)		
• At least nine (9) credits that are not used to meet any other department, college, or university requirement.		
<b>Total Credits</b>		<b>15</b>

For the undergraduate curriculum in agricultural systems technology leading to the degree of bachelor of science or for the undergraduate curriculum in industrial technology leading to the degree of bachelor of science.

The department also offers an undergraduate curricula and courses in agricultural engineering, biological systems engineering.

## Certificate in Occupational Safety

The Department of Agricultural and Biosystems Engineering offers a undergraduate certificate in occupational safety (<http://www.abe.iastate.edu/undergraduate-students/industrial-technology/certificate-in-occupational-safety/>) which may be earned by completing a minimum of 20 credits of technology systems management courses, which includes:

TSM 270	Principles of Injury Prevention and Safety	3
TSM 370	Occupational Safety	3
TSM 371	Occupational Safety Management	2
TSM 372	Legal Aspects of Occupational Safety and Health	2
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
6 credits from a departmentally approved list		6
TSM 493D	Workshop in Technology: Occupational Safety (Note: This course needs to be the last course taken toward completion of the Occupational Safety Certificate)	1-4