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.

3. 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:

1. Design, implement, and evaluate occupational safety and health programs for work environments.
2. Identify, assess, and analyze hazards and loss-producing conditions in work environments.
3. 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 1500	Critical Thinking and Communication	3
ENGL 2500	Written, Oral, Visual, and Electronic Composition	3
LIB 1600	Introduction to College Level Research	1
One of the following:		3
ENGL 3020	Business Communication	
ENGL 3090	Proposal and Report Writing	
ENGL 3140	Technical Communication	
AGEDS 3270	Survey of Agriculture and Life Sciences Communication	
One of the following:		3
SPCM 2120	Fundamentals of Public Speaking	
COMST 2140	Professional Communication	
AGEDS 3110	Presentation and Sales Strategies for Agricultural Audiences	
Total Credits		**13**

Mathematical, Physical, and Life Sciences: 25 cr.

STAT 1040	Introduction to Statistics	3
MATH 1450	Applied Trigonometry	3
MATH 1510	Calculus for Business and Social Sciences	3
PHYS 1310	General Physics I	4
PHYS 1310L	General Physics I Laboratory	1
CHEM 1630	College Chemistry	4
CHEM 1630L	Laboratory in College Chemistry	1
One of the following:		3
BIOL 1010	Introductory Biology	
BIOL 2110	Principles of Biology I	
BIOL 2120	Principles of Biology II	
BIOL 2510	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 2550	Fundamentals of Human Anatomy	
Total Credits		**25**

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

Occupational safety option must take ACCT 2150

ACCT 2840	Financial Accounting	3
or ACCT 2150	Legal Environment of Business	
ECON 1010	Principles of Microeconomics	3
TSM 3700	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
Total Credits		**18**

Technical Core: 28 cr.

TSM 1100	Introduction to Technology	1
TSM 1110	Experiencing Technology	1
TSM 1150	Solving Technology Problems	3
TSM 1160	Introduction to Design in Technology	3
TSM 2010	Preparing for Workplace Seminar	1
TSM 2100	Fundamentals of Technology	3
TSM 2140	Managing Technology Projects	1
TSM 2700	Principles of Injury Prevention and Safety	3
TSM 3100	Total Quality Improvement	3
TSM 3630	Electrical Power and Control Systems for Agriculture and Industry	4
TSM 3970	Summer Internship in Technology	
or TSM 3990	Internship in Technology	
TSM 4150	Applied Project Management in Technology	2
TSM 4160	Technology Capstone	3
Total Credits		**28**

TSM 3970 or TSM 3990 may count toward graduation.

Manufacturing Option: 36 cr.

One of the following:		1
ABE 2710	Engineering Applications of Parametric Solid Modeling	
ABE 2720	Parametric Solid Models, Drawings, and Assemblies Using Creo Parametric	
ABE 2730	CAD for Process Facilities and Land Use Planning	
TSM 2160	Advanced Technical Graphics, Interpretation, and CAD	2
TSM 2400	Introduction to Advanced Manufacturing and Metals Processing	3
TSM 2410	Introduction to Manufacturing Processes for Plastics	2
TSM 3370	Fluid Power Systems Technology	3
TSM 3400	Advanced Automated Manufacturing Processes	3
TSM 4400	Cellular Lean Manufacturing Systems	3
TSM 4430	Statics and Strength of Materials for Technology	3
TSM 4440	Facility Planning	3
TSM 4490	Applied Nondestructive Testing and Evaluation.	3
TSM 4650	Automation Systems	3
7 credits of free electives		7
Total Credits		**36**

Occupational Safety Option: 36 cr.

TSM 2400	Introduction to Advanced Manufacturing and Metals Processing	3
TSM 3710	Occupational Safety Management	2
TSM 3720	Legal Aspects of Occupational Safety and Health	2
TSM 3760	Fire Protection and Prevention	3
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
TSM 4710	Safety Laboratory	1
TSM 4770	Risk Analysis and Management	3
HS 1050	First Aid and Emergency Care	2
PSYCH 2500	Psychology of the Workplace	3
14 credits of free electives		14
Total Credits		**36**

Biological and Biomanufacturing Systems Technology Option: 36 cr.

BIOL 2120	Principles of Biology II	3
CHEM 2110	Quantitative and Environmental Analysis	2
CHEM 2110L	Quantitative and Environmental Analysis Laboratory	2
LDST 3220	Leadership in a Diverse Society	3
MICRO 2010	Introduction to Microbiology	2
MICRO 2010L	Introductory Microbiology Laboratory	1
TSM 3800	Fundamentals, Applications, and Modeling of Biological Systems	3
Select 15 credits from departmental list		15
5 credits of free electives		5
Total Credits		**36**

Industrial Technology, B.S. - Manufacturing option

First Year

Fall	Credits	Spring	Credits
TSM 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	ECON 1010	3
CHEM 1630L	1		
	16		**15**

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	TSM 2160	2
TSM 2100	3	TSM 2410	2
TSM 2140	1	STAT 1040	3
TSM 2400	3	BIOL 1010 or 2110	3
TSM 2700	3	International Perspectives - See list*	3
ENGL 2500	3	SPCM 2120, COMST 2140, or AGEDS 3110	3
	14		**16**

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3400	3	TSM 3100	3	TSM 3970 or 3990	R
TSM 3630	4	TSM 3370	3		
ACCT 2840 or 2150	3	TSM 3700 (Ethics requirement)	3		

US Diversity - See list*	3	ABE 2710, 2720, or 2730	1	
ENGL 3020, 3090, 3140, or AGEDS 3270	3	Humanities - See list*	3	
		Life Science - See list*	3	
	16		**16**	**0**

Fourth Year

Fall	Credits	Spring	Credits
TSM 4150	2	TSM 4160	3
TSM 4400	3	TSM 4440	3
TSM 4430	3	TSM 4650	3
TSM 4490	3	Elective	4
Elective	3		
	14		**13**

* 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 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	ECON 1010	3
CHEM 1630L	1		
	16		**15**

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	TSM 2400	3
TSM 2140	1	TSM 3710	2
TSM 2100	3	HS 1050	2
TSM 2700	3	STAT 1040	3
ENGL 2500	3	SPCM 2120, COMST 2140, or AGEDS 3110	3
BIOL 2510	3	BIOL 2550	3
	14		**16**

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3630	4	TSM 3100	3	TSM 3970 or 3990	R
TSM 3720	2	TSM 3700	3		
TSM 3760	3	TSM 4710	1		
ENGL 3020, 3090, 3140, or AGEDS 3270	3	TSM 4700	3		
Elective	3	ACCT 2150	3		
		International Perspectives*	3		
	15		**16**		**0**

Fourth Year

Fall	Credits	Spring	Credits
TSM 4150	2	TSM 4160	3
TSM 4770	3	US Diversity*	3
PSYCH 2500	3	Humanities*	3
Elective	6	Elective	5
	14		**14**

* 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 1100	1	TSM 1110	1
TSM 1160	3	TSM 1150	3
ENGL 1500	3	MATH 1510	3
LIB 1600	1	PHYS 1310	4
MATH 1450	3	PHYS 1310L	1
CHEM 1630	4	ECON 1010	3
CHEM 1630L	1		
	16		**15**

Second Year

Fall	Credits	Spring	Credits
TSM 2010	1	CHEM 2110	2
TSM 2140	1	CHEM 2110L	2
TSM 2100	3	STAT 1040	3
BIOL 2110	3	BIOL 2120	3
TSM 2700	3	LDST 3220	3
ENGL 2500	3		
	14		**13**

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 3100	3	TSM 3800	3	TSM 3970 or 3990	R
TSM 3630	4	MICRO 2010	2		
ACCT 2840 or 2150	3	MICRO 2010L	1		
Speech Communication - See list*	3	TSM 3700 (Ethics requirement)	3		
Option core course - See list*	3	Humanities - See list*	3		
		International Perspectives - See list*	3		
	16		**15**		**0**

Fourth Year

Fall	Credits	Spring	Credits
Option core course - See list*	3	TSM 4160	3
TSM 4150	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
	15		**16**

* 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

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 1150	Solving Technology Problems	3
TSM 2100	Fundamentals of Technology	3
9 credits from:		9
TSM 2160	Advanced Technical Graphics, Interpretation, and CAD	
TSM 2400	Introduction to Advanced Manufacturing and Metals Processing	
TSM 2410	Introduction to Manufacturing Processes for Plastics	
TSM 2700	Principles of Injury Prevention and Safety	
TSM 3100	Total Quality Improvement	
TSM 3370	Fluid Power Systems Technology	
TSM 3400	Advanced Automated Manufacturing Processes	
TSM 3630	Electrical Power and Control Systems for Agriculture and Industry	
TSM 3700	Occupational Safety	
TSM 3710	Occupational Safety Management	
TSM 3720	Legal Aspects of Occupational Safety and Health	
TSM 3760	Fire Protection and Prevention	

TSM 4400	Cellular Lean Manufacturing Systems
TSM 4430	Statics and Strength of Materials for Technology
TSM 4440	Facility Planning
TSM 4490	Applied Nondestructive Testing and Evaluation.
TSM 4650	Automation Systems
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards
TSM 4710	Safety Laboratory
TSM 4770	Risk Analysis and Management
• At least six (6) credits of 3000-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.	
Total Credits	**15**

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 an 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 2700	Principles of Injury Prevention and Safety	3
TSM 3700	Occupational Safety	3
TSM 3710	Occupational Safety Management	2
TSM 3720	Legal Aspects of Occupational Safety and Health	2
TSM 4700	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
6 credits from a departmentally approved list		6
TSM 4930D	Workshop in Technology: Occupational Safety (Note: This course needs to be the last course taken toward completion of the Occupational Safety Certificate)	1-4