

Industrial Engineering (BS)

Ranked in the top 15, the Edward P. Fitts Department of Industrial and Systems Engineering (ISE) offers an undergraduate program leading to a Bachelor of Science in Industrial Engineering.

What is Industrial & Systems Engineering?

Industrial engineers are problem solvers! We analyze processes and ask, "how can we make these processes faster, better, and cheaper?" ISEs play a pivotal role in end-to-end business operations from product development to product and service delivery. It is this holistic view that makes ISE unique. We rely heavily on gathering and evaluating data to help make decisions that are based on statistical and engineering methods. Here are some of the tasks that ISEs lead in industry:

- Assess the feasibility of manufacturing a new product with existing technologies, resources, and capacity or develop new ways to make products, including automation
- Create and monitor quality plans that ensure that faulty products will not be shipped to the customer.
- Determine improved methods of scheduling patients for surgery that decreases patient wait time and surgeon's overtime.
- Model a retail chain's inventory and supply chain methods to improve on-time deliveries.
- Develop computer simulation models to design and control large complex manufacturing, supply chain, or service delivery systems.
- Design controls in an airplane cockpit that are human-centered.

As you can see ISEs enjoy the freedom to explore almost any industry. The career paths that you can take with ISE are virtually limitless! Discover more about a career in ISE! (<https://www.ise.ncsu.edu/what-is-industrial-engineering/#careers-in-ie>)

Program Educational Objectives

The program educational objectives of the ISE department are to produce graduates capable of world-class performance in the following areas:

1. Applying the discipline's body of knowledge to the design and management of systems, products and processes.
2. Optimizing performance including the analysis of multiple constraints and conflicting objectives while evaluating the importance of time, cost, and quality.
3. Leading and collaborating on teams in the workplace while assessing the economic, societal, and ethical impacts to customers and communities.
4. Communicating effectively with all stakeholders to ensure meaningful and sustainable solutions.
5. Adapting to changes in technology and our global society through continuous learning.

Curriculum

Throughout the curriculum, students will develop a breadth of knowledge in all of the ISE focus areas, resulting in a broad base of knowledge and skills. There is a pervasive thread throughout the curriculum on the measurement, design, and continuous improvement of production and service systems. The result is a data-driven, efficiency-focused engineer who is highly attractive in many industry segments. Our courses are designed to be hands-on, whether that is in our state-of-the-art laboratories or using the latest software applications to solve real problems. The senior design capstone course is designed to give students an opportunity to apply what they have learned in the classroom to solve an industry-sponsored project. In addition to ISE courses, students take a wide variety of science, engineering, math, and statistics courses to form a well-rounded education.

The Bachelor of Science in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET: <https://www.abet.org> (<https://www.abet.org/>).

Admissions and Certification of Minor

The minor must be completed no later than the semester in which the student expects to graduate from his or her degree program. Documentation for certification of the minor can be found online (https://studentservices.ncsu.edu/forms/registrar/declare_minor.pdf).

The form should be completed no later than during the registration period for the student's final semester at NC State and submitted to Registration & Records for processing.

For more information contact:

Kanton Reynolds, Ph.D.
kreynolds@ncsu.edu
919.515.0605

Health Systems Engineering Specialization

This program is designed to provide you with a learning experience in preparation for a career in the healthcare field. After successful completion of the program, your Health Systems Engineering Specialization will make you more marketable for a future career in the healthcare industry.

Requirements

- A minimum GPA of 3.3
- Your resume (maximum of 2 pages)
- A brief statement of why you are interested in a career in healthcare (no more than 1 page, please)
- One ISE faculty recommendation
- An unofficial transcript
- All materials should be submitted to healthsystems@ncsu.edu by the deadlines listed below:
- Undergraduates – October 1st * (Must be eligible to graduate by Spring semester of the following year)
- Graduate Students – December 20th

For more information contact:

Corey Kiassat, Ph.D.

ackiassa@ncsu.edu (<http://catalog.ncsu.edu/undergraduate/engineering/industrial-systems/industrial-engineering-bs/ackiassa@ncsu.edu>)

Accelerated Baccalaureate/Masters (ABM) Program

This program will allow exceptional undergraduate students to complete both undergraduate and graduate degrees at an accelerated pace. The student is allowed up to 12 credit hours to be counted towards both the undergraduate and graduate degrees.

For more information contact:

Kanton Reynolds, Ph.D.
kreynolds@ncsu.edu
 919.515.0605

Requirements

- Students must have completed a minimum of 75 credit hours and up to a maximum of 96 credit hours by the end of the current semester (includes transfer credits).
- Students must have earned a GPA of at least 3.5 overall with a 3.5 (or higher) for all Industrial Engineering courses.
- Students must have satisfied all prerequisite requirements for 400-level courses.
- A letter of recommendation from the undergraduate teaching adviser identifying the applicant as a participant in the ABM program should accompany the application as well as the course numbers and titles of the 12 credit hours to be used for both the bachelor's and master's degree programs.

For more information about this department, including contact information, visit the department (<https://www.ise.ncsu.edu/>) website.

4221 Fitts-Woolard Hall
 919.515.2362

Plan Requirements

First Year

Fall Semester		Hours
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory ¹	4
E 101	Introduction to Engineering & Problem Solving	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research ²	4
MA 141	Calculus I ¹	4
Hours		14

Spring Semester

PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory ¹	4
MA 241	Calculus II ¹	4
Select one of the following:		3
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
EC 201	Principles of Microeconomics	

EC 205	Fundamentals of Economics	
E 102	Engineering in the 21st Century	2
Hours		13

Second Year

Fall Semester

ISE 135	Computer-Based Modeling for Industrial Engineering ³	3
MA 242	Calculus III	4
MSE 200 or MSE 201	Mechanical Properties of Structural Materials or Structure and Properties of Engineering Materials	3
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
ST 371	Introduction to Probability and Distribution Theory ²	3
Hours		17

Spring Semester

ECE 331	Principles of Electrical Engineering	3
ISE 215	Foundations of Design & 3D Modeling for Engineers	1
ISE 216	Product Development and Rapid Prototyping	3
MA 303	Linear Analysis ^{1, 4}	3
ST 372	Introduction to Statistical Inference and Regression	3
Hours		13

Third Year

Fall Semester

ISE 311	Engineering Economic Analysis	3
ISE 315	Introduction to Computer-Aided Manufacturing	1
ISE 316	Manufacturing Engineering I - Processes	3
CE 214	Engineering Mechanics-Statics	3
ISE 361	Deterministic Models in Industrial Engineering	3
Ethics Electives (p. 3)		
Hours		13

Spring Semester

Engineering Sciences Elective (p. 3)		3
ISE 352 or ISE 443	Fundamentals of Human-Machine Systems Design or Quality Design and Control	3
ISE 362	Stochastic Models in Industrial Engineering	3
ISE 443	Quality Design and Control	3
Technical Elective (p. 3)		3
Hours		15

Fourth Year

Fall Semester

ISE 408 or ISE 441 or ISE 453	Design and Control of Production and Service Systems or Introduction to Simulation or Modeling and Analysis of Supply Chains	3
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ISE 398	Lean Six Sigma for Industrial Engineering	1
ISE 441 or ISE 408 or ISE 453	Introduction to Simulation or Design and Control of Production and Service Systems or Modeling and Analysis of Supply Chains	3
Select one of the following:		3
ISE 520	Healthcare Systems Performance Improvement I	
Technical Elective (p. 3)		
ISE 453	Modeling and Analysis of Supply Chains	
ENG 331	Communication for Engineering and Technology	3
Hours		13
Spring Semester		
ISE 498 or ISE 521	Senior Design Project or Healthcare Systems Performance Improvement II	3
Technical Elective (p. 3)		3
Hours		6
Total Hours		104

¹ A grade of C or higher is required.

² A grade of C- or higher is required.

Code	Title	Hours
GEP Courses		
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)		
Total Hours		17

Engineering Sciences Electives

Code	Title	Hours
CE 225	Mechanics of Solids	3
CE 282	Hydraulics	3
MAE 201	Thermal-Fluid Sciences	3
MAE 208	Engineering Dynamics	3
MAE 214	Solid Mechanics	3
MAE 308	Fluid Mechanics	3

MSE 355	Electrical, Magnetic and Optical Properties of Materials	3
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Ethics Electives

Code	Title	Hours
IDS 201	Environmental Ethics	3
IDS 303	Humans and the Environment	3
NR 303	Humans and the Environment	3
PHI 214	Issues in Business Ethics	3
PHI/STS 325	Bio-Medical Ethics	3
STS 214	Introduction to Science, Technology, and Society	3
STS 302	Contemporary Science, Technology and Human Values	3
STS 304	Ethical Dimensions of Progress	3
STS 322	Technological Catastrophes	3

Technical Electives

Code	Title	Hours
BEC 475/575	Global Regulatory Affairs for Medical Products	3
E 304	Introduction to Nano Science and Technology	3
ECE/MAE 482	Engineering Entrepreneurship Senior Design I	3
ID 240	Human-Centered Design	3
ISE 411/511	Supply Chain Economics and Decision Making	3
ISE 413/513	Humanitarian Logistics	3
ISE 416	Manufacturing Engineering II - Automation	3
ISE 417	Database Applications in Industrial & Systems Engineering	3
ISE 425/525/OR 525	Medical Decision Making	3
ISE 433/533/OR 533	Service Systems Engineering	3
ISE 435/535	Python Programming for Industrial & Systems Engineers	3
ISE 437	Data Analytics for Industrial Engineering	3
ISE 447/547	Applications of Data Science in Healthcare	3
ISE 452	Advanced Human-Machine Systems Design	3
ISE 489	Special Topics in Industrial and Systems Engineering	3
ISE 495	Project Work in Industrial Engineering	1-3
ISE 519	Database Applications in Industrial and Systems Engineering	3
ISE 520	Healthcare Systems Performance Improvement I	3
ISE 553	Modeling and Analysis of Supply Chains	3
ISE 540	Human Factors In Systems Design	3
ISE 541	Occupational Safety Engineering	3
ISE 544	Occupational Biomechanics	3
ISE 552	Design and Control of Production and Service Systems	3
MSE 445/545	Ceramic Processing	3
MSE 565	Introduction to Nanomaterials	3
PSE 476	Environmental Life Cycle Analysis	3
PSY 340	Human Factors Psychology	3
PSY 400	Perception	3
PSY 420	Cognitive Processes	3

ST 430	Introduction to Regression Analysis	3
ST 431	Introduction to Experimental Design	3
ST 432	Introduction to Survey Sampling	3
TE 301	Engineering Textile Structures I: Linear Assemblies	3
TE 302	Textile Manufacturing Processes and Systems II	4
TE/TMS 565	Textile Composites	3

Industrial Engineering (BS) (14IEBS)

Semester Sequence

This is a sample.

First Year

Fall Semester		Hours
CH 101 & CH 102 or PY 205 and PY 206	Chemistry - A Molecular Science or Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory	4
E 101	Introduction to Engineering & Problem Solving	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research	4
MA 141	Calculus I	4
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		15
Spring Semester		
EC 205 or EC 201 or ARE 201 or ARE 201A	Fundamentals of Economics or Principles of Microeconomics or Introduction to Agricultural & Resource Economics or Introduction to Agricultural & Resource Economics	3
MA 241	Calculus II	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory	4
E 102	Engineering in the 21st Century	2
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		17

Second Year

Fall Semester		
ISE 135	Computer-Based Modeling for Industrial Engineering	3
MA 242	Calculus III	4
MSE 200 or MSE 201	Mechanical Properties of Structural Materials or Structure and Properties of Engineering Materials	3

PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
ST 371	Introduction to Probability and Distribution Theory ²	3

Hours **17**

Spring Semester

ECE 331	Principles of Electrical Engineering	3
ISE 215	Foundations of Design & 3D Modeling for Engineers	1
ISE 216	Product Development and Rapid Prototyping	3
MA 303	Linear Analysis	3
ST 372	Introduction to Statistical Inference and Regression	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3

Hours **16**

Third Year

Fall Semester		
ISE 311	Engineering Economic Analysis	3
ISE 316	Manufacturing Engineering I - Processes	3
ISE 315	Introduction to Computer-Aided Manufacturing	1
CE 214 or MAE 206	Engineering Mechanics-Statics or Engineering Statics	3
Ethics (p. 3)		Verify
ISE 361	Deterministic Models in Industrial Engineering	3

Hours **13**

Spring Semester

Engineering Science Elective (p.)		3
ISE 352 or ISE 443	Fundamentals of Human-Machine Systems Design or Quality Design and Control	3
ISE 362	Stochastic Models in Industrial Engineering	3
ISE 443	Quality Design and Control	3
Technical Elective (p. 3)		3

Hours **15**

Fourth Year

Fall Semester		
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
ISE 408 or ISE 441 or ISE 453	Design and Control of Production and Service Systems or Introduction to Simulation or Modeling and Analysis of Supply Chains	3
ISE 441 or ISE 408 or ISE 453	Introduction to Simulation or Design and Control of Production and Service Systems or Modeling and Analysis of Supply Chains	3
ISE 398	Lean Six Sigma for Industrial Engineering	1

Select one of the following: **3**

ISE 520	Healthcare Systems Performance Improvement I	
Technical Elective (p.)		
ISE 453	Modeling and Analysis of Supply Chains	3
ENG 331	Communication for Engineering and Technology	3
Hours		19
Spring Semester		
ISE 498 or ISE 521	Senior Design Project (CP) or Healthcare Systems Performance Improvement II	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Technical Elective (p. 3)		3
Technical Elective (p. 3)		3
		3
Hours		15
Total Hours		127

Career Opportunities

Industrial and Systems engineers can be found everywhere! According to the Bureau of Labor Statistics, ISEs will be highly sought after in the coming decade. This is not surprising given the cost and efficiency pressure on both manufacturing and service sectors. Industrial engineers are hired by virtually all segments of industry.

Industrial Engineers may work in hospitals and healthcare consulting firms to make healthcare delivery more cost effective as well as in high tech manufacturing industries. Another area in which ISEs play a pivotal role, is in successful integration of global business partners. As companies continue to seek a global presence, industrial engineers will be involved in the design of new supply chain networks or qualification of manufacturing processes/facilities.

Given the level of impact made by ISEs in industry today it is not surprising that our current job placement rate is among the highest in the College of Engineering, above 90% within 3 months of graduation. Many ISEs rise to the management ranks throughout the career and there have been several ISEs who have become CEOs: Tim Cook (Apple Inc.), Mike Duke (Walmart) & Charles Holliday (Dupont) to name a few.

Career Titles

- Airport Engineer
- Cost Estimator
- Energy Engineer
- Engineering Professor
- Factory Layout Engineer
- Industrial Designer
- Industrial Engineer
- Industrial Engineering Technologists and Technicians
- Manufacturing Engineers
- Nanotechnology Engineering Technologists and Technicians
- Product Safety Engineer
- Quality Control Managers
- Solar Energy Systems Engineers
- Transportation Engineer

Learn More About Careers

NCCareers.org (<https://nccareers.org/>)

Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (<https://www.bls.gov/ooh/>)

Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (<https://www.careeronestop.org/>)

View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (<https://careers.dasa.ncsu.edu/explore-careers/career-assessments/>) (NC State student email address required)

This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (<https://careers.dasa.ncsu.edu/about/hours-appointments/>) to discuss the results.

Focus 2 Apply Assessment (<https://www.focus2career.com/Portal/Register.cfm?SID=1929>) (Available to prospective students)

A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

Institute of Industrial & Systems Engineers (<http://www.iienet2.org/Default.aspx>)

Human Factors and Ergonomic Society (<https://www.hfes.org/home/>)

Society for Health Systems (<https://www.iise.org/shs/>)

Association for Supply Chain Management (<https://www.ascm.org/>)

Institute for Operations Research & the Management Sciences (<https://www.informs.org/>)

National Society of Professional Engineers (<https://www.nspe.org/>)