Industrial Engineering (INEG)

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Industrial Engineering Website (http://www.ineg.uark.edu/)

The mission of the industrial engineering department at the University of Arkansas is to be a nationally competitive, student-centered industrial engineering program serving Arkansas and the world through undergraduate and graduate studies and leading-edge research programs.

Industrial engineers are concerned with improving organized activity. The physical arrangement of people, equipment, and material significantly influences the effectiveness of any organization – whether the organization is industrial, governmental, or commercial.

Today’s industrial engineers develop applications of new processing automation and control technology; install data processing systems, performance measures and standards, job evaluation and wage and salary programs; research new products and product applications; devise ways to improve productivity through application of technology and human factors; select operating processes and methods to accomplish a given task using proper tools and equipment; design facilities, management systems, operations procedures, storage systems; improve allocation of resources, planning and control systems for distribution of goods and services, production, inventory, quality and plant maintenance; enhance plant environment and the quality of working life; evaluate reliability and quality performance; implement office systems, procedures, and policies; analyze complex business problems through operations research; conduct long-range organization studies, plant location surveys, system effectiveness studies; and study potential markets for goods and services, raw material sources, labor supply, energy resources, financing and taxes.

Industrial engineers integrate engineering skills with mathematics and computer science tools, providing systematic ways to maximize productivity and quality while minimizing time and cost.

Completion of the degree requirements provides graduates with the following learning outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- An ability to communicate effectively with a range of audiences
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The goal of the Industrial Engineering Undergraduate Program at the University of Arkansas is to prepare men and women for professional careers and graduate studies in Industrial Engineering. We provide a foundation in mathematics, science, humanities and social sciences, engineering science, and engineering design to produce Industrial Engineers with the intellectual, technical, and professional competence to develop, implement, and manage industrial engineering solutions to complex problems in industry, government, and society.

The program's objectives have been developed to address the needs of the industrial engineering constituencies and to be consistent with and supportive of the department's mission and programmatic goals. The IE program educational objectives represent and describe the expected accomplishments of graduates resulting from participation within the program within the first few years after graduation. The program’s objectives have been developed to address the needs of departmental constituencies and to be consistent with and support the mission and programmatic goals.

Within 3-5 years of graduation, graduates of the U of A undergraduate program in industrial engineering will have:

1. Successfully applied core industrial engineering knowledge and skills for industrial or public sector organizations.
2. Successfully pursued advanced professional degrees, graduate studies in industrial engineering, professional training, or engineering certification.
3. Demonstrated professional and intellectual growth as managers and leaders in industrial engineering, society, and their communities.

Requirements for B.S. in Industrial Engineering and Operations Analytics

The total graduation requirement in industrial engineering and operations analytics is 123 hours. For further information please visit the departmental website (http://www.ineg.uark.edu/).

Technical Electives

The purpose of technical electives is to provide students with the opportunity to expand their education along lines of particular interest to them. Each student is responsible for their technical elective program. Students may seek specific advice on technical elective selections from their advisor. Courses satisfying technical elective requirements cannot fulfill more than one B.S.I.E.O.A. requirement.

A minimum of 12 credit hours from the approved technical elective course list must be taken to satisfy technical elective requirements for the B.S.I.E.O.A. At least 6 of these 12 credit hours must be chosen from INEG, EMGT, and/or OPAN courses. No more than 3 of these credits may be based in individual/ independent study, no more than 3 of these credits may be based in INEG 400HV Honors Thesis and no more than 3 of these credits may be based in cooperative education.

Approved Technical Elective Course List

1. Any BENG, BIOL, BMEG, CHEG, CHEM, CVEG, CSCE, DASC, ELEG, EMGT, GNEG, INEG, MATH, MEEG, OMGT, OPAN, and PHYS course that is at the 3000-level or above is approved. Exceptions are:
   - CVEG 45103 is not approved.
   - EMGT 57003 is not approved.
   - GNEG 38001 is not approved.
   - GNEG 38101 is approved only if the student has completed at least three semesters of GNEG 38101.
   - INEG 33103 is not approved.
   - MATH 30103 and MATH 31303 are not approved.
   - OMGT 43203, OMGT 43303, OMGT 48503, OMGT 52503, OMGT 53703, OMGT 54203, OMGT 54603, OMGT 56703, and OMGT 57803 are not approved.
   - PHYS 36003 is not approved.
2. Students may count one of MATH 26004 and MATH 25804 as a technical elective.
3. Courses at the 3000-level or above that are explicitly listed (not part of a blanket statement like "… 3000-to- 4000-level …") in the Catalog of Studies under Minors for Non-Business Students (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/sammwaltoncollegeofbusiness/minors/) are approved. Exception:
   - ISYS 33903 is not approved if the student is also seeking technical elective credit for INEG 46803.
4. Courses at the 3000-level or above that are explicitly listed on the Sustainability Minor Courses (https://sustainability.uark.edu/academics/minor.php) website under Natural, Managed, or Built Systems are approved.
5. GEOS courses at the 3000-level or above that are explicitly listed in the Catalog of Studies in the Data Science B.S. with Geospatial Data Analytics Concentration (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/interdisciplinarystudies/datasciencedasc/#bswithgeospatialdataanalyticsconcentrationtext) are approved.
6. Additional approved courses are EXSC 31503, EXSC 33503, and HNRS 401H3.

Industrial Engineering and Operations Analytics B.S.I.E.O.A. Eight-Semester Degree Program

The following section contains the list of courses required for the Bachelor of Science in Industrial Engineering and Operations Analytics degree and a suggested sequence. Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites. Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) in the Academic Regulations chapter for university requirements of the program.

Students are required to complete 40 hours of upper division courses (3000-4000 level). It is recommended that students consult with their adviser when making course selections.

First Year	Units	
	Fall	Spring
GNEG 11101 Introduction to Engineering I	1	
MATH 24004 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)[1]	4	
CHEM 14103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3	
ENGL 10103 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)[1]	3	
Select one of the following courses to satisfy General Education Outcomes 3.3 and 4.2:[1]	3	
HIST 20103 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)		
HIST 20003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)		
PLSC 20003 American National Government (ACTS Equivalency = PLSC 2003)		
GNEG 11201 Introduction to Engineering II		1
MATH 25004 Calculus II		4
ENGL 10303 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2)[1, 2]		3
BIOL 10103/10101 or CHEM 14203/14201 or GEOL 11103/11101 or PHYS 20404		4
PHYS 20304 University Physics I (ACTS Equivalency = PHYS 2034) (Satisfies General Education Outcome 3.4)[1]		4
Year Total:	14	16

Second Year	Units	
	Fall	Spring
INEG 20001 Industrial Engineering Seminar	1	
INEG 21003 Introduction to Industrial Engineering	3	
INEG 22104 Computing Methods for Industrial Engineers I	4	
INEG 23104 Statistics for Industrial Engineers I	4	
Math Elective: Choose one of the following	3	
MATH 26004 Calculus III		
MATH 26004 Calculus III		
MATH 260H4 Honors Calculus III		
MATH 25804 Elementary Differential Equations		
MATH 258H4 Honors Elementary Differential Equations		
MATH 26103 Discrete Mathematics		
MATH 30803 Linear Algebra		
INEG 22203 Computing Methods for Industrial Engineers II		3
INEG 23203 Probability and Stochastic Processes for Industrial Engineers		3
INEG 24103 Engineering Economic Analysis		3
INEG 26103 Introduction to Operations Research		3

ACCT 24003 Accounting Fundamentals for Planning and Control		3
Year Total:	15	15

Third Year	Units	
	Fall	Spring
INEG 33303 Statistics for Industrial Engineers II	3	
INEG 34403 Project Management	3	
INEG 35403 Facility Logistics	3	
INEG 36204 Simulation	4	
Select one of the following two options to satisfy General Education Outcome 3.3:[1]	3	
ECON 21403 Basic Economics: Theory and Practice		
or		
ECON 21003 Principles of Macroeconomics (ACTS Equivalency = ECON 2103) & ECON 22003 Principles of Microeconomics (ACTS Equivalency = ECON 2203)		
INEG 35503 Production Planning and Control		3
INEG 35303 Transportation Logistics		3
INEG 37104 Work Methods and Ergonomics		4
INEG 38303 Introduction to Database Concepts for Industrial Engineers		3
Social Science Elective - Choose a course that satisfies General Education Outcomes 3.3 and 4.1.[1]		3
Year Total:	16	16

Fourth Year	Units	
	Fall	Spring
INEG 44303 Systems Engineering and Management	3	
INEG 49103 Industrial Engineering Capstone Experience I	3	
Two Technical Electives	6	
Social Sciences Elective[1]	3	
INEG 49204 Industrial Engineering Capstone Experience II (Satisfies General Education Outcome 6.1)[1]		4
Two Technical Electives		6
Fine Arts Elective - Choose a course that satisfies General Education Outcome 3.1.[1]		3
Humanities Elective - Choose a course that satisfies General Education Outcomes 3.2 and 5.1.[1]		3
Year Total:	15	16

Total Units in Sequence:	**123**

[1] Students must complete the State Minimum Core requirements (https://nam03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fnextcatalog.uark.edu%2Fundergraduatecatalog%2Fgened%2Fstateminimum%2F&data=02%7C01%7Cagriffin%40uark.edu%7Ce4e632415f9b49eda9bf08d7f5c20b91%7C79c742c4e61c4fa5be89a3cb566a80d1%7C0%7C0%7C637248086069611524&sdata=4bJ2Oob83N8KfTkGD%2F1XG8924jwOx8pTlw8lWNAGp0s%3D&reserved=0) as outlined in the Catalog of Studies. The courses that meet the state minimum core also fulfill many of the university's General Education requirements (https://nam03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fnextcatalog.uark.edu%2Fundergraduatecatalog%2Fgened%2Fgeneraleducation%2F&data=02%7C01%7Cagriffin%40uark.edu%7Ce4e632415f9b49eda9bf08d7f5c20b91%7C79c742c4e61c4fa5be89a3cb566a80d1%7C0%7C0%7C637248086069611524&sdata=BDWRVEfAqIMsYNX4KXEgX2JdEJJY7Go%3D&reserved=0), although there are additional considerations to satisfy the general education learning outcomes. Students are encouraged to consult with their academic adviser when making course selections.

[2] Students who enter the university with credit for ENGL 10203 are not required to complete ENGL 10303. Students who enter the university with exemption from ENGL 10203 are encouraged to take ENGL 10303.

Minor in Engineering Management

Requirements for the minor in Engineering Management: The student must be pursuing a bachelor of science degree from an engineering program accredited by the Engineering Accreditation Commission of ABET. The minor requires completion of 15-16 credit hours of coursework.

INEG 24103	Engineering Economic Analysis	3
INEG 44303	Systems Engineering and Management	3
Select one of the following:		3-4
INEG 23104	Statistics for Industrial Engineers I	
INEG 33103	Engineering Probability and Statistics	
Select one of the following:		3
INEG 34403	Project Management	
CVEG 45103	Construction Management	
Select one of the following:		3
INEG 41203	Global Engineering and Innovation	
INEG 42503	Leadership Principles and Practices	
INEG 43203	Quality Engineering and Management	
INEG 44503	Productivity Improvement	
INEG 54303	Cost Estimation Models	
INEG 54403	Decision Models	
EMGT 50303	Introduction to Engineering Management	
Total Hours		**15-16**

Cassady, Richard, Ph.D., M.S.I.S.E., B.S.I.S.E. (Virginia Polytechnic Institute and State University), University Professor, 2000, 2019.
Chaovalitwongse, Wanpracha A., Ph.D., M.S. (University of Florida), B.Eng. (King Mongkut Institute of Technology), Research Professor, 2016.

Chimka, Justin Robert, Ph.D., M.S.I.E., B.S.I.E. (University of Pittsburgh), Associate Professor, 2002, 2009.
Eksioglu, Burak, Ph.D. (University of Florida), M.S.E.B.M. (University of Warwick), B.S.I.E. (Bogazici University), Professor, Hefley Professor in Logistics and Entrepreneurship, 2019.
Eksioglu, Sandra, Ph.D. (University of Florida), M.S.E.M.S. (Mediterranean Agronomic Institute of Chania), B.S.B.A. (University of Tirana), Professor, 2019.
English, John R., Ph.D. (Oklahoma State University) P.E., M.S.O.R., B.S.E.E. (University of Arkansas), Professor, Irma F. and Raymond F. Giffels Endowed Chair in Engineering, 1991, 1998.

Liao, Haitao, Ph.D., M.S., M.S.I.S.E. (Rutgers University), B.S.E.E. (Beijing Institute of Technology), Professor, John and Mary Lib White Endowed Systems Integration Chair, 2015.
Liu, Xiao, Ph.D. (National University of Singapore), B.S.M.E. (Harbin Institute of Technology, China), Assistant Professor, 2017.
Melton, Kerry D., Ph.D. (Oklahoma State University), M.S.I.E., B.S.I.E. (University of Arkansas), Teaching Associate Professor, 2023.
Milburn, Ashlea B., Ph.D. (Georgia Institute of Technology), M.S.I.E. (Virginia Polytechnic Institute and State University), B.S.I.E. (University of Arkansas), Associate Professor, John L. Imhoff Chair in Industrial Engineering, 2010, 2018.
Nachtmann, Heather, Ph.D., M.S.I.E., B.S.I.E. (University of Pittsburgh), Professor, 2000, 2013.
Needy, Kim LaScola, Ph.D. (Wichita State University), P.E., M.S.I.E., B.S.I.E. (University of Pittsburgh), Professor, 2008.
Nurre Pinkley, Sarah, Ph.D., M.Eng., B.S. (Rensselaer Polytechnic Institute), Assistant Professor, 2015.
Parnell, Gregory S., Ph.D. (Stanford University), M.S. (University of Southern California), M.E.I.S.E. (University of Florida), B.S. (University of New York at Buffalo), Professor of Practice, 2013.
Paulus, David, Ph.D. (Colorado State University), M.S.I.E, B.S.M.E. (University of Tennessee), Professor of Practice, 2023.
Pohl, Edward A., Ph.D., M.S.R.E. (University of Arizona), M.S.S.E. (Air Force Institute of Technology), M.S.E.M. (University of Dayton), B.S.E.E. (Boston University), Professor, Twenty-First Century Professorship in Engineering, 2004, 2013.
Pohl, Letitia, Ph.D. (University of Arkansas), M.S.S.E. (Air Force Institute of Technology), B.S.M.E. (Tulane University), Teaching Associate Professor, 2013, 2021.
Rainwater, Chase E., Ph.D. (University of Florida), B.S.I.E. (University of Arkansas), Professor, 2009, 2021.
Rossetti, Manuel D., Ph.D., P.E., M.S.I.E. (The Ohio State University), B.S.I.E. (University of Cincinnati), University Professor, 1999, 2022.
Schubert, Karl, Ph.D. (University of Arkansas), M.S.Ch.E. (University of Kentucky), B.S.Ch.E (University of Arkansas), Professor of Practice, 2016.
Shen, Haoming, Ph.D. (University of Michigan, Ann Arbor), M.S.E.E., M.S.M. (University of Michigan, Ann Arbor), B.S.E.E. (Xi'an Jiatong University), Assistant Professor, 2023.
Squires, Alice F., Ph.D. (Stevens Institute of Technology), M.B.A. (George Mason University), B.S.E.E. (University of Maryland), Teaching Professor, 2023.
Sullivan, Kelly M., Ph.D. (University of Florida), M.S.I.E., B.S.I.E. (University of Arkansas), Associate Professor, 2012, 2019.
Zhang, Shengfan, Ph.D., M.I.E. (North Carolina State University), B.M. (Fudan University, Shanghai), Associate Professor, John L. Imhoff Chair in Industrial Engineering, 2011, 2020.

Courses

INEG 20001. Industrial Engineering Seminar. 1 Hour.
Overview of the Department of Industrial Engineering: faculty and their backgrounds and interests, staff and the services they provide, facilities, curricular requirements, extracurricular opportunities, post-graduate opportunities. (Typically offered: Fall)

INEG 21003. Introduction to Industrial Engineering. 3 Hours.
Survey of industrial engineering problems. Application of key concepts from linear algebra and calculus in solving industrial engineering problems. Use of spreadsheets in solving industrial engineering problems. Visualization of common types of industrial engineering data. Exploration of the principles of effective teamwork and professionalism. Prerequisite: MATH 24005 or MATH 25104 or MATH 24004. (Typically offered: Fall and Spring)

INEG 22104. Computing Methods for Industrial Engineers I. 4 Hours.
Introduction to programming and computing methods within the context of traditional industrial engineering problem solving. Students will be exposed to classic industrial engineering problem scenarios. Basic techniques within object-oriented programming, including designing classes, using objects, creating methods, looping and decision constructs, arrays, and file handling, will be used to facilitate solving these problems. Pre- or Corequisite: INEG 21003. (Typically offered: Fall and Spring)

INEG 22203. Computing Methods for Industrial Engineers II. 3 Hours.
A continuation of INEG 22104. Review of fundamental computing methods and exposure to advanced use of computing libraries. Developing and implementing algorithms using computing methods to solve illustrative and practical problems of interest to industrial engineers. Students will use existing computing libraries, data structures, and programming interfaces to implement software using problem-based learning. Prerequisite: INEG 22104. (Typically offered: Fall and Spring)

INEG 23104. Statistics for Industrial Engineers I. 4 Hours.
Applications to industrial engineering of descriptive statistics, single-population point and interval estimation, single-population hypothesis testing, two-population point and interval estimation, two-population hypothesis testing, goodness-of-fit testing, contingency table testing, linear regression, correlation, design of experiments, and analysis of variance. Introduction to statistical quality control. Use of modern statistical analysis software is emphasized. Corequisite: Drill component. Prerequisite: IEOA or DTSC students only. Pre- or corequisite: INEG 21003 or DASC 25904. (Typically offered: Fall and Spring)

INEG 231H4. Honors Statistics for Industrial Engineers I. 4 Hours.
Applications to industrial engineering of descriptive statistics, single-population point and interval estimation, single-population hypothesis testing, two-population point and interval estimation, two-population hypothesis testing, goodness-of-fit testing, contingency table testing, linear regression, correlation, design of experiments, and analysis of variance. Introduction to statistical quality control. Use of modern statistical analysis software is emphasized. Corequisite: Drill component. Prerequisite: Honors standing, and IEOA or DTSC students only. Pre- or corequisite: INEG 21003 or DASC 25904. (Typically offered: Fall and Spring)
This course is equivalent to INEG 23104.

INEG 23203. Probability and Stochastic Processes for Industrial Engineers. 3 Hours.
Development and analysis of industrial engineering applications of random experiments, random variables, renewal processes, Poisson processes, and Markov chains. Application areas include inventory, quality control, queueing, and reliability. Pre- or corequisite: INEG 21003 or DASC 25904. (Typically offered: Fall and Spring)

INEG 23303. Applied Probability and Statistics for Engineers II. 3 Hours.
Applications to engineering problems of two-population point and interval estimation, two-population hypothesis testing, linear regression, correlation, design of experiments, analysis of variance, and nonparametric statistics. Introduction to statistical quality control. Corequisite: Drill component. Prerequisite: INEG 23104. (Typically offered: Fall and Spring)

INEG 24103. Engineering Economic Analysis. 3 Hours.
Economic aspects of engineering, including current economic problems and the treatment of estimates when evaluating alternative courses of action. Methods of selection and replacement of equipment and break-even points of operation; desirability of new processes or projects where asset life, rate of return on investment, and first, fixed, differential, marginal, and sunk costs must be considered. Corequisite: Drill component. Prerequisite: MATH 24005 or MATH 25104 or MATH 24004. (Typically offered: Fall and Spring)

INEG 26103. Introduction to Operations Research. 3 Hours.
Introduction to modeling and analysis of deterministic operations design and planning problems using formal optimization algorithms and software. Identification and formulation of appropriate applications, linear programming, sensitivity, network flows/transportation/assignment problems, shortest paths, and integer linear programming. Prerequisite: INEG 22104 or DASC 12004. Pre- or corequisite: INEG 21003 or MATH 30803 or DASC 25904. (Typically offered: Fall and Spring)

INEG 33103. Engineering Probability and Statistics. 3 Hours.
Applications to engineering problems of data summary and presentation, random variables and probability distributions, point and interval estimation, hypothesis testing, linear regression, and design of experiments. Not for credit toward the Bachelor of Science in Industrial Engineering. Corequisite: Drill component. Prerequisite: MATH 25004. (Typically offered: Fall, Spring and Summer)

INEG 33303. Statistics for Industrial Engineers II. 3 Hours.
Introduction to model statistical learning, statistical learning beyond linear regression, data-driven anomaly detection and process monitoring, optimal sampling for data collection. Prerequisite: INEG 22203, INEG 23104 and INEG 23203. (Typically offered: Fall and Spring)

INEG 34403. Project Management. 3 Hours.
Analysis of the strategic level of project management including planning, organizing, and staffing for successful project execution. Professional creativity, motivation, leadership, and ethics are also explored. At the tactical level, project selection, control, and systems management are analyzed. Systems development and decision support tools for project management are studied. (Typically offered: Fall and Spring)

INEG 344H3. Honors Project Management. 3 Hours.
Analysis of the strategic level of project management including planning, organizing, and staffing for successful project execution. Professional creativity, motivation, leadership, and ethics are also explored. At the tactical level, project selection, control, and systems management are analyzed. Systems development and decision support tools for project management are studied. (Typically offered: Fall and Spring)
This course is equivalent to INEG 34403.

INEG 35103. Manufacturing Processes. 3 Hours.
This course focuses on the manufacturing processes that impart geometry and properties to engineering materials including casting, metalworking, machining, joining, heat treatment, and polymer processes. Process selection and analysis, design-for-manufacturing principles, cost estimation, and selection of process parameters are covered. Lab component covers communication of manufacturing specifications via engineering drawings. Prerequisite: MEEG 23003. Corequisite: Lab component. (Typically offered: Spring)

INEG 35303. Transportation Logistics. 3 Hours.
This course introduces students to transportation and logistics systems, including the components of logistics system and their interactions. There is emphasis on quantitative models and techniques for the optimization and analysis of transportation and logistics systems. Topics covered include: an overview of logistics systems and modes of transportation; facility location analysis and network design; network flow and transportation modeling; and vehicle routing. Prerequisite: INEG 26103. Pre- or corequisite: INEG 22203 or DASC 12004. (Typically offered: Fall and Spring)

INEG 35403. Facility Logistics. 3 Hours.
The design and analysis of efficient logistics systems at the facility level, with an emphasis on distribution facilities. Unit load, break bulk, crossdock and order fulfillment centers and their component systems and software. Automated and manual systems.Prerequisite: INEG 24103. Pre- or corequisite: INEG 26103. (Typically offered: Fall and Spring)

INEG 35503. Production Planning and Control. 3 Hours.
Strategy and competition, forecasting, aggregate planning, inventory control subject to known demand, inventory control subject to uncertain demand, supply chain management, push and pull production control systems, and operations scheduling. Prerequisite: INEG 23104 or STAT 30043. Pre- or corequisite: INEG 26103. (Typically offered: Fall and Spring)

INEG 36204. Simulation. 4 Hours.
The development and use of discrete-event simulation models for the analysis and design of systems found in manufacturing, distribution, and service contexts. Coverage includes conceptual modeling, model translation to computer form, statistical input models, random number generation and Monte Carlo methods, experimentation and statistical output analysis, and queuing analysis. Includes the use of modern computer simulation languages. Corequisite: Drill component. Prerequisite: (INEG 22203 or DASC 12004), INEG 23104 and INEG 23203. Pre- or Corequisite: INEG 24103. (Typically offered: Fall and Spring)

INEG 362H4. Honors Simulation. 4 Hours.
The development and use of discrete-event simulation models for the analysis and design of systems found in manufacturing, distribution, and service contexts. Coverage includes conceptual modeling, model translation to computer form, statistical input models, random number generation and Monte Carlo methods, experimentation and statistical output analysis, and queuing analysis. Includes the use of modern computer simulation languages. Corequisite: Drill component. Prerequisite: (INEG 22203 or DASC 12004), INEG 23104, INEG 23203 and honors standing. Pre- or corequisite: INEG 24103. (Typically offered: Fall and Spring)
This course is equivalent to INEG 36204.

INEG 37104. Work Methods and Ergonomics. 4 Hours.
Ways of designing jobs, machines, operations and work environments so they are compatible with human capacities and limitations. Work methods topics include methods analysis, time studies, work sampling and learning curves. Cognitive and physical capabilities and limitations of humans are addressed through the study of human information processing, motor control theory, anthropometry, biomechanics, work physiology and manual material handling. Design of controls and displays, hand tools and workstations, along with work related musculoskeletal disorders. Laboratory required. Corequisite: Lab component. Prerequisite: INEG 23104. (Typically offered: Fall and Spring)

INEG 381H2. Honors Industrial Engineering Research Experience I. 2 Hours.
Introduction to the research of the faculty of the Department of Industrial Engineering for the purpose of matching students with an undergraduate research advisor. Development of skills in using electronic resources to conduct background research on individuals and topics in the engineering academic community. Development of scientific presentation skills. Prerequisite: Instructor permission and honors standing. (Typically offered: Spring)

INEG 38303. Introduction to Database Concepts for Industrial Engineers. 3 Hours.
An introduction to the basic principles of database modeling and technologies for industrial engineers. Coverage includes analyzing user requirements, representing data using conceptual modeling techniques (e.g. UML, ERD), converting conceptual models to relational implementations via database design methodologies, extracting data via structured query language processing, and understanding the role of database technology in industrial engineering application areas, implementing database applications. Pre- or corequisite: INEG 22203. (Typically offered: Fall and Spring)

INEG 400HV. Honors Thesis. 1-3 Hour.
For Honors College students majoring in Industrial Engineering only. Prerequisite: Honors college students only and instructor consent. (Typically offered: Fall, Spring and Summer)

INEG 4100V. Special Topics in Industrial Engineering. 1-4 Hour.
Consideration of current industrial engineering topics not covered in other courses. Prerequisite: Senior standing. (Typically offered: Irregular) May be repeated for up to 4 hours of degree credit.

INEG 410HV. Honors Special Topics in Industrial Engineering. 1-3 Hour.
Consideration of current industrial engineering topics not covered in other courses. Prerequisite: Senior standing. (Typically offered: Irregular) May be repeated for up to 3 hours of degree credit.
This course is equivalent to INEG 4100V.

INEG 4110V. Individual Study in Industrial Engineering. 1-3 Hour.
Individual study and research on a topic mutually agreeable to the student and a faculty member. Prerequisite: Instructor consent. (Typically offered: Fall, Spring and Summer)

INEG 411HV. Honors Individual Study in Industrial Engineering. 1-3 Hour.
Individual study and research on a topic mutually agreeable to the student and a faculty member. Prerequisite: Instructor consent and honors candidacy. (Typically offered: Fall, Spring and Summer)
This course is equivalent to INEG 4110V.

INEG 41203. Global Engineering and Innovation. 3 Hours.
This course provides engineering students a global perspective for design and innovation. Students explore various design thinking tools and techniques. Students apply engineering design and innovation techniques to create solutions that meet specified markets with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors. Students also have the opportunity to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which considers the impact of the engineering solution in the global, economic, environmental, and social contexts. Prerequisite: Senior standing or instructor consent. (Typically offered: Irregular)

INEG 41403. Data Mining. 3 Hours.
The course focuses on the principles, theory, design, and implementation of data mining algorithms for large-scale data. Topics include foundations of data mining; preprocessing; mining frequent patterns, associations and correlations; supervised learning including decision tree induction, naïve Bayesian classification, support vector machine, logistic regression, Bayesian network, and K-nearest neighbor learning; unsupervised learning including K-means clustering, hierarchical clustering, density-based clustering, and grid-based clustering; outlier analysis; graph mining; scalable and distributed data mining. Prerequisite: (INEG 23303 and INEG 22203) or (CSCE 20104 and INEG 33103) or (INEG 23104 and INEG 22203) or INEG 33303. (Typically offered: Fall)

INEG 41603. Introduction to Modern Statistical Techniques for Industrial Applications. 3 Hours.
This application-oriented course is driven by real problems arising from industry and focuses on problem solving using both modern and classic statistical methods. For both senior undergraduate and graduate students, the main goal of this course is to provide a comprehensive introduction to those most popular statistical learning methods and tools (such as R and Apache Spark) which are widely used in industry today. Prerequisite: INEG 23303 or INEG 23104 or INEG 33303. (Typically offered: Spring)

INEG 42503. Leadership Principles and Practices. 3 Hours.
The course is designed to expose students to multiple approaches to leadership in a wide variety of settings. Leadership styles, the knowledge areas and competencies expected of today's leaders, the challenges leaders face, the historical and philosophical foundations of leadership, the relationships among leadership theory, leadership practice, and the moral-ethical aspects of leadership are among the topics covered in the course. A number of respected regional, national, and international leaders share "lessons learned" in their leadership journeys. Plus, a number of highly regarded leadership books and case studies on leadership are read and discussed. Students may not receive credit for INEG 42503 and INEG 52503/OMGT 52503. Prerequisite: Senior standing. (Typically offered: Fall)

INEG 425H3. Honors Leadership Principles and Practices. 3 Hours.
The course is designed to expose students to multiple approaches to leadership in a wide variety of settings. Leadership styles, the knowledge areas and competencies expected of today's leaders, the challenges leaders face, the historical and philosophical foundations of leadership, the relationships among leadership theory, leadership practice, and the moral-ethical aspects of leadership are among the topics covered in the course. A number of respected regional, national, and international leaders share "lessons learned" in their leadership journeys. Plus, a number of highly regarded leadership books and case studies on leadership are read and discussed. Students may not receive credit for INEG 42503 and INEG 52503/OMGT 52503. Prerequisite: Honors standing and instructor consent. (Typically offered: Fall)
This course is equivalent to INEG 42503.

INEG 43203. Quality Engineering and Management. 3 Hours.
Provides the student with complete coverage of the functional area of "Quality Assurance" ranging from the need for such a function, how it works, techniques utilized, and managerial approaches for insuring its effectiveness. Prerequisite: INEG 23303 or INEG 23104 or INEG 33103. (Typically offered: Irregular)

INEG 44203. Advanced Engineering Economy. 3 Hours.
Preparation of feasibility studies, including cost estimation, risk and uncertainty, sensitivity analysis and decision making. Effects of taxes, depreciation and financing costs on cash flows. Prerequisite: (INEG 23303 or INEG 23104 or INEG 33103) and INEG 24103. (Typically offered: Irregular)

INEG 442H3. Honors Advanced Engineering Economy. 3 Hours.
Preparation of feasibility studies, including cost estimation, risk and uncertainty, sensitivity analysis and decision making. Effects of taxes, depreciation and financing costs on cash flows. Prerequisite: INEG 23104 and INEG 24103. (Typically offered: Irregular)
This course is equivalent to INEG 44203.

INEG 44303. Systems Engineering and Management. 3 Hours.
Overview of the fundamental concepts underlying the management of engineering. Reviews the engineering decision process within the life cycle. Examines implementation of basic management functions in technical organizations and development of strategy tools within a complex organization. Prerequisite: INEG 24103. (Typically offered: Fall)

INEG 443H3. Honors Systems Engineering and Management. 3 Hours.
Overview of the fundamental concepts underlying the management of engineering. Reviews the engineering decision process within the life cycle. Examines implementation of basic management functions in technical organizations and development of strategy tools within a complex organization. Prerequisite: INEG 24103. (Typically offered: Fall)
This course is equivalent to INEG 44303.

INEG 44503. Productivity Improvement. 3 Hours.
Analysis of common productivity problems. Development of skills required to diagnose problems; measure productivity; develop improvement strategies; and provide for the implementation and maintenance of productivity measurement and improvement systems. Prerequisite: Senior standing. (Typically offered: Irregular)

INEG 46803. Decision Support in Industrial Engineering. 3 Hours.
Reinforcing important computer programming methods using industrial engineering-based applications. Students will utilize Microsoft Excel and Visual Basic for Applications to develop custom solutions to challenging industrial engineering problems. Emphasis on computational proficiency and computing productivity in a spreadsheet-based setting. Prerequisite: (INEG 22104 or DASC 12004) and INEG 23104. (Typically offered: Fall)

INEG 481H1. Honors Industrial Engineering Research Experience II. 1 Hour. Development of an undergraduate research proposal with an emphasis on scientific writing skills. Development of skills in using electronic resources to conduct background research related to proposed research. Introduction to the peer review process and nationally competitive awards. Prerequisite: INEG 381H2 and honors standing. (Typically offered: Fall)

INEG 49103. Industrial Engineering Capstone Experience I. 3 Hours. First semester of a two-semester, team-based project in support of a real-world industry partner organization. Learn about the industry partner organization and the relevant segment of that organization. Assess and evaluate the operations and performance of the system that needs to be improved, or detail the need for and the requirements of a new system. Communicate findings using reports and presentations. Prerequisite: INEG 20001, INEG 21003, INEG 33303, INEG 34403, INEG 35403 and INEG 36204. Pre- or corequisite: INEG 35303, INEG 35503, INEG 37104, INEG 38303 and INEG 44303. (Typically offered: Fall)

INEG 49204. Industrial Engineering Capstone Experience II. 4 Hours. Second semester of a two-semester, team-based project in support of a real-world industry partner organization. Develop and assess recommendations for improving system performance, or develop the detailed design of a new system. Evaluate the potential impact of the project. Develop deliverables for the industry partner organization. Communicate findings using reports and presentations. Students must have successfully completed INEG 49103 in the immediate prior semester. Corequisite: Lab component. Prerequisite: INEG 35303, INEG 35503, INEG 37104, INEG 38303, INEG 44303 and INEG 49103. (Typically offered: Spring)