Industrial Engineering (INEG)

Faculty

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Wanpracha Art Chaovatwitnongse, Professor, 21st Century Leadership Chair in Engineering

Justin Robert Chimka, Associate Professor

John R. English, Professor, Irma F. and Raymond F. Giffels Endowed Chair in Engineering

Joseph Patrick Geunes, Professor

Haitao Liao, Professor, Heffley Professor in Logistics and Entrepreneurship

Ashlea R. Milburn, Assistant Professor

Heather Nachtmann, Professor

Kim LaScola Needy, Professor

Sarah Nurre, Assistant Professor

Gregory S. Parnell, Research Professor

Kim Petrone, Instructor

Harry A. Pierson, Assistant Professor

Edward A. Pohl, Professor, Twenty-First Century Professorship in Engineering

Letitia Pohl, Clinical Assistant Professor

Chase E. Rainwater, Associate Professor, John L. Imhoff Chair in Industrial Engineering

Manuel D. Rossetti, Professor

Kelly M. Sullivan, Assistant Professor

John A. White Jr., Distinguished Professor

Shengfan Zhang, Assistant Professor

Ed Pohl

Head of the Department

4207 Bell Engineering Center

479-575-3156

http://www.ineg.uark.edu/

The mission of the industrial engineering department 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 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

The total graduation requirement in industrial engineering is 128 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 within a particular area of interest. The approved list of technical electives is available in the industrial engineering department. At least 12 hours must be selected from INEG courses.

Humanities/Social Science Electives

Although any elective included on the approved University Core humanities/social science list may be selected, PSYC 2003 General Psychology (ACTS Equivalency = PSYC 1103) (Sp, Su, Fa) is recommended for industrial engineers.

Science Electives

The approved list of science electives is available in the industrial engineering departmental office.
Technical Elective Requirements

Each student is responsible for his or her 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 industrial engineering degree requirement.

A minimum of 18 credit hours from the approved technical elective course list must be taken to satisfy technical elective requirements within the Industrial Engineering program. At least 12 of these 18 credit hours must be chosen from INEG 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 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, BMIS, CHEM, CHEG, CSCE, ELEG, GNEG, INEG, MATH, MEENG, and PHYS course that is at the 3000 level or above and not required for the BSIE is approved. Exceptions are:
   a. GNEG 3801 is not approved.
   b. GNEG 3811 is approved only if the student has completed at least three semesters of GNEG 3811.
   c. CVEG 4513 is not approved if the student is also seeking technical elective credit for INEG 4443.
   d. MATH 3133 is not approved.
   e. PHYS 3603, PHYS 4103, and PHYS 4203 are not approved.

2. 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. Exceptions are:
   a. ISYS 3393 is not approved if the student is also seeking technical elective credit for INEG 4683.
   b. MEEG 2303 Introduction to Materials (Sp, Fa)

3. Courses at the 3000 level or above that are explicitly listed on the Sustainability Minor Courses website (http://sustainability.uark.edu/academics/minor) under Natural, Managed, or Built Systems are approved.

4. Additional approved courses are CSCE 2014, EXSC 3153, and EXSC 3353.

Industrial Engineering B.S.I.E.
Eight-Semester Degree Program

The following section contains the list of courses required for the Bachelor of Science in Industrial Engineering 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.

At least 12 hours of technical electives must be selected from INEG courses.

**First Year**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Fall</th>
<th>Units</th>
<th>Spring</th>
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<tr>
<td>MATH 2554</td>
<td>Calculus I (ACTS Equivalency = MATH 2405)</td>
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<td>CHEM 1103</td>
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<td>GNEG 1111</td>
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<td>ENGL 1013</td>
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<td>HIST 2003</td>
<td>History of the American People to 1877 (ACTS Equivalency = HIST 2113)</td>
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<td>GNEG 1121</td>
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<td>INEG 2403</td>
<td>Industrial Cost Analysis</td>
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<tr>
<td>INEG 2333</td>
<td>Applied Probability and Statistics for Engineers I</td>
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<td>INEG 2413</td>
<td>Engineering Economic Analysis</td>
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<td>MATH 2574</td>
<td>Calculus III (ACTS Equivalency = MATH 2603)</td>
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<td>INEG 2403</td>
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<td>INEG 2333</td>
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<td>MATH 2584</td>
<td>Elementary Differential Equations (Sp, Su)</td>
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<td>MEEG 2303</td>
<td>Introduction to Materials (Sp, Fa)</td>
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<td>CSCE 2004</td>
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**Second Year**

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<td>INEG 2103</td>
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<td>MEEG 2303</td>
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<td>CSCE 2004</td>
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**Third Year**

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<td>INEG 3623</td>
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<td>INEG 3713</td>
<td>Methods and Standards (Sp, Fa)</td>
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<td>MEEG 2003</td>
<td>Statics (Sp, Su, Fa)</td>
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<td>ELEG 3903</td>
<td>Electric Circuits and Machines (Sp, Fa)</td>
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</table>
**Courses**

**INEG 2001. Introduction to Industrial Engineering Seminar (Fa).** 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.

**INEG 2002. Industrial Engineering Seminar (Sp).** 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.

**INEG 2003. Introduction to Industrial Engineering (Fa).** 3 Hours.

Introduction to the technical content of industrial engineering and the use of computing in the solution of traditional industrial engineering problems. Computer tools include spreadsheets, programming, and mathematical analysis software. Corequisite: Lab component.

**INEG 2103. Applied Probability and Statistics for Engineers I (Sp, Fa).** 3 Hours.

Applications to engineering problems of probability theory and discrete and continuous random variables, descriptive statistics, single-population point and interval estimation, single-population hypothesis testing, goodness-of-fit testing, and contingency table testing. Corequisite: Drill component. Prerequisite: MATH 2564.

**INEG 213H. Honors Applied Probability and Statistics for Engineers I (Sp, Fa).** 3 Hours.

Applications to engineering problems of probability theory, discrete and continuous random variables, descriptive statistics, single-population point and interval estimation, single-population hypothesis testing, goodness-of-fit testing, and contingency table testing. Corequisite: Drill component. Prerequisite: MATH 2564. This course is equivalent to INEG 213.

**INEG 2333. Applied Probability and Statistics for Engineers II (Sp, Fa).** 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. Prerequisite: INEG 2313.

**INEG 2403. Industrial Cost Analysis (Sp).** 3 Hours.

Use of accounting information for planning and control with emphasis on the engineering viewpoint: introduction to general accounting procedures; principles of cost accounting and other aspects of production costs; budgeting, depreciation, taxes, distribution of profits, securities, sources of corporate capital, interpretation of financial statements, and other related topics. Laboratory required. Corequisite: Lab component.

**INEG 2413. Engineering Economic Analysis (Sp, Fa).** 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 2554.

**INEG 2812H. Honors Industrial Engineering Research Experience I (Sp).** 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 industrial engineering academic community. Prerequisite: Instructor consent and honors standing.

**INEG 3513. Manufacturing Processes (Sp).** 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 2303. Corequisite: Lab component.

**INEG 3613. Introduction to Operations Research (Sp).** 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 2103 and MATH 2574.
INEG 3623. Simulation (Fa). 3 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 2333 and CSCE 2004.

INEG 3623H. Honors Simulation (Fa). 3 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: INEG 2333 and drill component. Prerequisite: INEG 2413 and CSCE 2004.

This course is equivalent to INEG 3623.

INEG 3713. Methods and Standards (Sp, Fa). 3 Hours.
Fundamental rules of motion economy; motion analysis by means of charts; diagrams; work place design; tool and equipment selection; operator selection; and job description and analysis. Fundamentals of time study; observed and synthetic times; use of standard data and time formula; leveling; rating; allowances; and work sampling. Laboratory required. Corequisite: Lab component. Prerequisite: INEG 2313.

INEG 3723. Ergonomics (Sp, Fa). 3 Hours.
The capabilities and limitations of humans are addressed in the context of the person's interaction with machines and the environment. Topics of discussion include anthropometric considerations in design, neurophysiological capabilities in the work environment, selection and training of workers, and the design of controls and displays. Corequisite: Lab component. Prerequisite: INEG 2333 and INEG 3713.

INEG 3812H. Honors Industrial Engineering Research Experience II (Fa), 2 Hours.
Development of an undergraduate research proposal. Introduction to the peer review process. Examination of conference travel, nationally-competitive award, and graduate fellowships. Emphasis on technical communication skills. Prerequisite: INEG 2812H and honors standing.

INEG 400VH. Honors Thesis (Sp, Su, Fa). 1-3 Hour.
For Honors College students majoring in Industrial Engineering only. Prerequisite: Honors college students only and instructor consent.

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

INEG 410VH. Honors Special Topics in Industrial Engineering (Irregular). 1-3 Hour.
Consideration of current industrial engineering topics not covered in other courses. Prerequisite: senior standing. May be repeated for up to 3 hours of degree credit.

This course is equivalent to INEG 410V.

INEG 411V. Individual Study in Industrial Engineering (Sp, Su, Fa). 1-3 Hour.
Individual study and research on a topic mutually agreeable to the student and a faculty member. Prerequisite: Instructor consent.

INEG 411VH. Honors Individual Study in Industrial Engineering (Sp, Su, Fa). 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.

This course is equivalent to INEG 411V.

INEG 4223. Occupational Safety and Health Standards (Irregular). 3 Hours.
Survey of existing and proposed standards by examining fundamental physical, economic, and legal bases. Performance vs. specific standards. Enforceability and data collection. National consensus and promulgation process. Includes a computer-based design project. Prerequisite: INEG 2313.

INEG 4223H. Honors Occupational Safety and Health Standards (Irregular). 3 Hours.
Survey of existing and proposed standards by examining fundamental physical, economic, and legal bases. Performance vs. specific standards. Enforceability and data collection. National consensus and promulgation process. Includes a computer-based design project. Prerequisite: INEG 2313.

This course is equivalent to INEG 4223.

INEG 4253. Leadership Principles and Practices (Fa). 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 4253 and INEG 5253/OMGT 5253. Prerequisite: Instructor consent.

This course is cross-listed with INEG 4253H.

INEG 4253H. Honors Leadership Principles and Practices (Fa). 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 4253 and INEG 5253/OMGT 5253. Prerequisite: Honors standing and instructor consent.

This course is cross-listed with INEG 4253.

INEG 4223. Quality Engineering and Management (Irregular). 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 2333.

INEG 4323. Quality Engineering and Management (Irregular). 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 2333.

INEG 4323H. Honors Quality Engineering and Management (Irregular). 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 2333.

Studies of human cognition in work settings in order to enhance performance of cognitive tasks through an understanding of cognitive processes (e.g., attention, perception errors, decision making, workload) required of operators in modern industries. Emphasis lies on how to (re)design human-machine interfaces and cognitive artifacts so that human well-being and system performance are optimized in work environments. Prerequisite: CSCE 2004.

Fundamentals of modeling risk, analyzing risk, and managing risk in a variety of industrial and government decision-making settings. Risk measurement and model building, uncertainty quantification, and multi-objective trade-offs. Prerequisite: INEG 2313 and INEG 4553.

INEG 4423. Advanced Engineering Economy (Irregular). 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 2413.
INEG 4423H. Honors Advanced Engineering Economy (Irregular). 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 2413.
This course is equivalent to INEG 4423.

INEG 4433. Systems Engineering and Management (Fa). 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 2403.

INEG 4433H. Honors Systems Engineering and Management (Fa). 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 2403.
This course is equivalent to INEG 4433.

INEG 4443. Project Management (Irregular). 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. Prerequisite: Senior standing.

INEG 4443H. Honors Project Management (Irregular). 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. Prerequisite: Senior standing.
This course is equivalent to INEG 4443.

INEG 4453. Productivity Improvement (Irregular). 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.

INEG 4533. Application of Machine Vision (Sp). 3 Hours.
Automated machine vision applied to assembly and inspection tasks traditionally performed by human operators; development of application by acquiring image, processing image data, analyzing image and transmitting results; application analysis, selection and economics. Laboratory required. Corequisite: Lab component. Prerequisite: Senior standing.

INEG 4543. Facility Logistics (Irregular). 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. Corequisite: Lab component. Prerequisite: INEG 2413 and INEG 3613.

INEG 4553. Production Planning and Control (Fa). 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. Pre or Corequisite: INEG 3613. Prerequisite: INEG 2333.
INEG 4923. Industrial Engineering Capstone Experience II (Sp). 3 Hours.
Develop a written and oral report for a comprehensive project for an industrial sponsor. Complete identified tasks and measure success in achieving defined objectives using industrial engineering tools; create and document deliverables. Students must have successfully completed INEG 4911 in the immediately prior semester. Prerequisite: INEG 4911.