RUTGERS–NEW BRUNSWICK
School of Engineering

Undergraduate Handbook: Department of Industrial & Systems Engineering

Academic Year 2024-2025

Updated 06/21/2024

What Is Industrial Engineering?

According to the Institute of Industrial Engineers (1975), the Industrial Engineering profession is described as follows:

"Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of people, materials, equipment, and energy. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from such systems."

What are the Program Educational Objectives (PEOs) of the Industrial and Systems Engineering Department at Rutgers University?

The Program Educational Objectives (see http://ise.rutgers.edu) of the Industrial Engineering program are aligned with Rutgers University's mission of sustaining highest standards in teaching, research and public service and to educate exceptional leaders of the next generation. They are also aligned with the School of Engineering (SOE) mission.

The **Program Educational Objectives (PEOs)** are:

1. *Graduates will meet the expectations of employers of Industrial engineers.*
2. *Qualified graduates will pursue advanced study if they so desire.*
3. *Graduates will pursue leadership positions in their profession and/or communities.*

To meet these objectives, the department has designed its curriculum in order to insure the following Student Outcomes (SOs):

The following list of **Student Outcomes** is currently used to evaluate the IE program and is listed on the department web site. A graduate who has successfully gained all the skills, knowledge, and behaviors present in the following outcomes would have a complete knowledge and training necessary to achieve the program's objectives. Each Industrial Engineering student will have demonstrated the following:

1. *an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics*
2. *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*
3. *an ability to communicate effectively with a range of audiences*
4. *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*
5. *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*
6. *an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions*
7. *an ability to acquire and apply new knowledge as needed, using appropriate learning*

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1. INDUSTRIAL ENGINEERING CURRICULUM

Freshman Year	(18 cr. hrs.)		(17 cr. hrs.)
01:160:159	Gen Chem for Eng.	3	01:160:160 Gen Chem for Eng. 3
01:160:171	Intro to Experiment	1	01:640:152 Calc Math Phy Sci 4
01:355:101	Expository Writing	3	01:750:124 Analytic Physics IB 2
01:640:151	Calc Math Phy Sci	4	14:440:102 Data Drive Design II 2
01:750:123	Analytic Physics IA	2	14:440:221 Engr Mech-Statics 3
14:440:101	Data Driven Des I	2	__:___:___ Hum/Soc Elective 3
__:___:___	Hum/Soc. Elective	3	

Sophomore Year	(17 cr. hrs.)		(16 cr. hrs.)
01:640:251	Multivar Calc	4	
01:750:227	Analytic Phys IIA	3	01:640:244 Diff Eqns Eng & Ph 4
01:750:229	Anal Phys II Lab	1	14:540:343 Eng. Economics 3
33:010:310	Account for Eng.	3	14:540:210 Eng Probability 3M
14:540:201	Work Des & Ergo	3M	01:355:302 Sci & Tech Writing 3
14:540:202	Work Des Lab	1M	14:440:222 Eng Mech-Dyn 3M
14:540:213	IE Lab	2M	

Junior Year	(17 cr. hrs.)		(16 cr. hrs.)
14:540:320	Eng Statistics	3M	14:540:303 Mfg. Processes 3M
14:180:215	Eng. Graphics	1M	14:540:304 Mfg. Processes Lab 1M
14:332:221	Prin of EE I	3M	14:540:311 Deter. Models in OR 3M
14:635:407	Mech. Prop Materials	3M	14:540:384 Simulat. Models IE 3M
14:540:338	Prob. Models in OR	3M	14:540:399 Design of Eng Syst I 3M
14:540:382	Automation	3M	__:___:___ Dpt/Tech Elec (List B) 3M
14:540:383	Automation Lab	1M	

Senior Year	(16 cr. hrs.)		(12 cr. hrs.)
14:540:400	Design of Eng Syst. II	3M	14:540:462 Fac Layout & MH 3M
14:540:433	Quality Eng	3M	__:___:___ Dpt/Tech Elec (List A) 3M
14:540:434	Quality Eng. Lab	1M	__:___:___ Hum/Soc Elective 3
14:540:453	Prod Plan & Control	3M	__:___:___ Hum/Soc Elective 3
14:540:487	Energy Sys Model	3M	
__:___:___	Dpt/Tech Elec (List B)	3M	

M - Course is included in major average.
Total credit hours: 129
Major credit hours total: 67

2. DEPARTMENTAL / TECHNICAL ELECTIVES

Students are required to take one course from the Departmental/Technical Electives List A (Design Elective) and **two** courses from the Departmental/Technical Electives List B. These lists are given below. Please note that you can substitute a List A elective for a List B elective (but not the reverse).

ISE and other listed graduate courses are possible technical electives for students with a 3.0 major average or greater. **Students must obtain permission from the Undergraduate Director to take a graduate course.** Note: This is a good practice for many students who are interested in pursuing graduate studies.

NOTE: Course # and title may be changed by other departments without our knowledge! Please inform the Undergraduate Director of any changes you are aware of.

LIST A

10:762:202 [1]	Designing Healthy Cities
10:762:472 [1]	Transportation Planning
10:971:316 [3]	Introduction to Site Planning and Urban Design
11:117:462 [3]	Design in Solid Waste Treatment Systems
11:117:468 [3]	Hazardous Waste Treatment Engineering
11:550:301 [1]	Social and Cultural Aspects of Design
14:440:403 [1]	Safety Engineering in Packaging
14:540:485 [1]	Industrial Information Systems
14:540:491/492 [1]	Introduction to Reliability Engineering (3.2 GPA required)
14:635:405 [1]	Solar Cell Design & Processing
16:540:575 [1]	Advanced Engineering Economics I
14:650:342 [3]	Design of Mechanical Components
14:650:388 [2]	Computer-Aided Design in Mechanical Engineering
14:650:455 [3]	Design of Mechanisms
33:390:380 [3]	Investment Analysis (pre-req: 33:390:310)
33:799:301 [1]	Intro. to Supply Chain Management

LIST B

01:198:112 [3]	Data Structures
01:198:205 [3]	Introduction to Discrete Structures
01:198:206 [2]	Introduction to Discrete Structures II
01:198:211 [3]	Computer Architecture
01:198:314 [3]	Principles of Programming Languages
01:198:323 [2]	Numerical Analysis and Computing
01:198:336 [3]	Principles of Information and Data Management
01:198:440 [2]	Introduction to Artificial Intelligence
01:220:311 [3]	Methods of Cost-Benefit
01:220:322 [3]	Econometrics
01:220:334 [3]	Energy Economics
01:220:485 [3]	Advanced Microeconomic Theory
01:640:250 [1]	Introductory Linear Algebra OR 01:640:350 Linear Algebra
01:640:300 [2]	Introduction to Mathematical Reasoning
01:640:321 [1]	Introduction to Applied Mathematics
01:640:373 [1]	Numerical Analysis
01:640:423 [2]	Elementary Partial Differential Equations (NB)
01:960:490 [1]	Introduction to Experimental Design
01:960:384 [1]	Intermediate Statistical Analysis
01:640:454 [2]	Combinatorics
01:750:313 [3]	Modern Physics
01:750:323 [3]	Advanced General Physics
01:750:324 [3]	Advanced General Physics
01:750:326 [3]	Computer Based Experimentation and Physics Computing
01:750:327 [1]	Modern Instrumentation
01:750:341 [1]	Principles of Astrophysics
01:750:381 [1]	Mechanics
01:750:397 [3]	Physics of Modern Devices
01:750:431 [1]	Introduction to Computational Biology for Physicists
01:750:464 [3]	Mathematical Physics
01:960:463 [2]	Regression Methods
10:971:201 [1]	Introduction to Urban Planning and Design
10:971:250 [1]	Introduction to GIS
10:971:315 [1]	Fundamentals of Urban Planning and Design
11:375:434 [3]	Principles of Industrial Hygiene
14:125:201 [1]	Introduction to Biomedical Engineering
14:125:304 [3]	Biomaterials
14:125:305 [3]	Numerical Modeling in Biomedical Systems
14:125:308 [3]	Biomechanics
14:125:409 [3]	Introduction to Prosthetic and Orthotic Devices
14:332:312 [1]	Discrete Mathematics
14:440:392 [1]	Undergraduate Research in Engineering (Aresty students ONLY - 3 cr. for entire year)

14:540:461 [1]	Engineering Law
14:540:485 [1]	Industrial Information Systems
14:540:496/497 [1]	Co-Op and Internship in ISE (upon approval of the undergrad director)
16:540:507 [1]	Data Analytics in Engineering Systems
16:540:580 [1]	Quality Management (requires 3.0)
14:635:361 [1]	Materials Science and Engineering of Polymers
14:635:440 [1]	Electrochemical Devices
14:650:350 [3]	Mechanical Engineering Measurements **with** co-requisite 14:650:349
14:650:401 [1]	Dynamic Systems and Control
14:650:447 [3]	Probabilistic Models in Mechanical and Aerospace Systems
14:650:449 [3]	Aerospace Materials
33:390:400 [3]	Corporate Finance (pre-req: 33:390:310)
33:390:420 [3]	Derivatives (pre-req: 33:390:380)
33:799:305 [2]	Procurement and Global Sourcing Strategy
33:799:380 [2]	Project Management
33:799:460 [2]	Introduction to Six Sigma & Lean Manufacturing

[1]Pre-requisites part of curriculum (or no pre-requisites)
[2]Requires another technical elective as a pre-requisite.
[3]Requires one (or more) pre-requisites that are not part of curriculum.

3. ACCEPTABLE HUMANITIES/SOCIAL SCIENCE ELECTIVES

For a list of the Humanities/Social Science Electives, please go to:

https://soe.rutgers.edu/oas/electives

4. ACADEMIC STANDING

For the School of Engineering Academic Standing Policy, please go to the link below:

http://soe.rutgers.edu/oas/scholasticstanding

5. SUMMARY OF ACADEMIC PROGRAMS

5.1. Five Year Dual Degree Program

The School of Engineering in cooperation with the liberal arts colleges at Douglass, Livingston, Rutgers, Camden and Newark offers cooperative five-year programs leading to a BS in Engineering and a BA in liberal arts major. The current Rutgers University Catalog gives the details of the program. To receive both degrees, it is necessary for the student to satisfy the following three requirements: (1) take all the courses required for the ISE degree; (2) take all courses required for the liberal arts major; and (3) make sure the total number of credits is the required number of ISE credits plus 30.

Some courses may satisfy both ISE and liberal arts requirements. For example, an ISE and Economics double major can satisfy engineering and liberal arts requirements with the sequence of courses Engineering Probability and Intermediate Statistics. In fact, it may be possible to fulfill the requirements for both degrees with fewer credits than the total ISE credits plus thirty. If that occurs, the student must take additional courses to satisfy item (3) above.

5.2. James J. Slade Scholar (Honors Program)

In the junior year, students with a GPA of 3.2 or better may apply for admission to this program. The program requires that you write a senior thesis. This program gives a student the opportunity to do independent research while still an undergraduate. Also, this program gives the student

recognition (at graduation and with a certificate) for outstanding achievement. For more information https://soe.rutgers.edu/research/student-research/james-j-slade-scholars-program.

5.3. Study Abroad

For more information on the Study Abroad Program visit https://soe.rutgers.edu/student-experience/study-abroad.

5.4. Engineers Made in Germany (EGIM) Program

Engineers Made in Germany Summer School at Pforzheim University is a 6 week program for Mechanical Engineering and Industrial Engineering students. Up to 9 credits can be earned toward your degree (6 credits of List B technical electives and 3 credits Humanities/Social Science electives). Please contact the Assistant Dean for Transfer Services for more information.

5.5. Internships and Co-Ops in ISE

The ISE Internship and Co-op Programs are opportunities for students to gain practical engineering work experience during their undergraduate education and to earn course credit for that can be applied towards their degree. ISE Work experience allows the student to draw on coursework to apply engineering knowledge and skills in various industrial and systems engineering environments.

Students are responsible to secure their own job opportunity by applying directly with the hiring company. Rutgers Career Services https://careers.rutgers.edu/ offers a range of support including online job listings and face-to-face career events. The department also emails ISE students job posts when they are received. Students are encouraged to take advantage of all support resources to help secure their own work experience opportunity.

The Internship Program is a short-term job experience where students work either full time during the summer or part-time during the fall/spring term. Students register for 540:496 and upon successful completion of the Internship, the course will be counted as a List B technical elective. To be eligible to receive course credit, the student must accumulate at least 135 hours of work experience, submit weekly reports and a final report at completion of the Internship. Students can earn credit for a second internship by registering for 540:497, following the same requirements as the first Internship, and upon successful completion the course will be counted as a second List B technical elective. Students can register and earn credit for a maximum of two technical electives, or a maximum of 6 credits applied towards their degree for Internships. The Co-Op Program is a longer-term full-time work experience typically lasting for a period of 6 months which includes a summer and overlapping spring or fall term. Students typically register part-time during the overlapping term for both 540:496 and 540:497. Upon successful completion, the Co-Op work experience will be counted as two List B technical electives. To be eligible to receive course credit, the student must accumulate at least 270 hours of work experience, submit weekly reports and a final report at completion of the Co-Op Program. Students earn credit for a maximum of two technical electives, or a maximum of 6 credits applied towards their degree for Co-Op experience. Note that a Co-Op Program with full-time employment overlapping a Fall or Spring term usually will require 9 (or more) semesters to complete the ISE degree requirements.

Note that students are free to pursue as many Internships or Co-Op Program experiences as they desire during their undergraduate education, however they can earn a maximum of 6 credits towards their degree.

Students interested in receiving credit for an Internship or a Co-Op work experience should make an appointment with the Undergraduate Director to have the program approved in advance before starting the job. The work experience cannot be approved for credit retroactively after the job starts or for previous work experience.

6. ACADEMIC POLICIES

This handbook has been compiled for undergraduate Industrial and Systems Engineering students. The department wants you to be aware of your degree requirements and of changes in college and university rules. We welcome suggestions for new material for the handbook and clarifications of material already included.

When you declare an engineering major, a check-list of course requirements is put into Degree Navigator. As you complete courses, the Dean's staff crosses the courses off the list. Check Degree Navigator often to monitor your progress.

Special advising hours are available during registration periods. At other times during the semester, you may make an appointment with the Undergraduate Director if the needed.

EACH STUDENT **MUST** BE AWARE THEY ARE ULTIMATELY THE PERSON RESPONSIBLE FOR COMPLETING THE BS DEGREE REQUIREMENTS.

Keep track of your own progress through the IE program and speak with the Undergraduate Director when you run into academic or other problems. Always make sure you are following the ISE Handbook curriculum guidelines when you are creating your schedule. During registration, look at the check-list of courses in Degree Navigator to make sure your understanding of your status agrees with the view of the School of Engineering. It is especially important for graduating seniors to check Degree Navigator with their advisors to ensure that summer courses, transfer credits, and electives have been recorded as expected.

Before meeting with your advisor each student should be well informed. Please be sure to read this handbook and the current New Brunswick Undergraduate Catalog. In particular, students should be familiar with the sections regarding ISE degree requirements, ISE courses, Academic Policies and Procedures, and University Policies and Procedures.

6.1. Major Average

The courses that are included in the major average are marked "M" on the ISE curriculum. To graduate, your major average must be 2.0 or greater. If you fail a course and then repeat it, both grades are computed into your major average.

Every semester, compute your major average. Keep track of it carefully.

6.2. Courses Included In Major Average

Please refer to this link: http://soe.rutgers.edu/oas/gpa-calculation

6.3. Withdrawal From Courses

It happens, unfortunately, that students encounter major problems during their college years. Don't wait to be dismissed from the School of Engineering to seek help. Take responsibility for your situation. If you know you are unable to do the required work, you must do what is necessary to let the college know of your difficulty. Further, there are many resources at Rutgers that can help you with your situation - from substance abuse to the death of a parent or friend.

Here are the rules: If you fail a course, it is computed into your university and major averages. If you drop a course, it is **not** computed into these averages.

6.4. Course Substitution

As a matter of policy, there are no course substitutions for ISE courses.

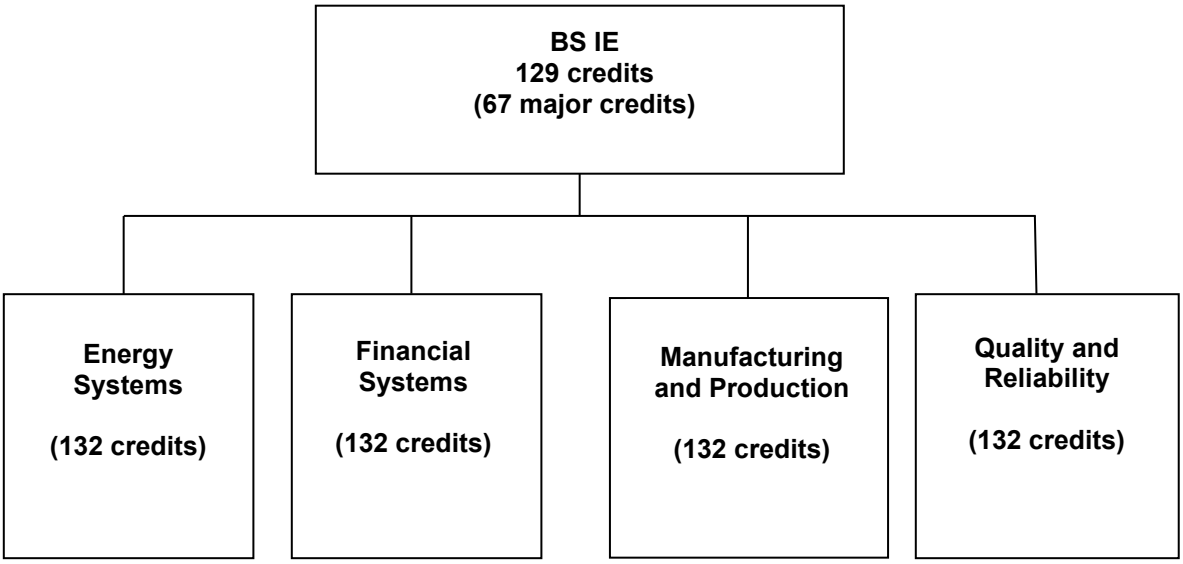
6.5. Academic Dishonesty

The Industrial and Systems Engineering Department expects each student to conduct him or herself in a professional manner. The policy of the ISE Department is as follows: we do not hesitate to report offenses of cheating to the school or the university. An engineer starting out a career cannot afford to have this kind of report on his or her record. A student who gives information is considered guilty as well as a student who receives information.

The University Policy on Academic Dishonesty is carefully spelled out in your catalog. Note that copying from or giving others assistance or using forbidden material on an hourly or final examination is a level two violation. A possible sanction is suspension from the university for one or more terms with a notation of academic disciplinary suspension placed on the student's transcript.

7. UNDERGRADUATE TRACKS

The IE program provides tracks that enable students to choose a specialization area in order to emphasize specific areas of interest. The IE curriculum offers four tracks as shown and explained below:



Each track consists of 12 credit hours (9 credit hours can be used to complete Dept/Tech Electives).

7.1 Energy Systems Track

Energy engineering or energy systems engineering is a broad field of engineering dealing with energy efficiency, energy services, facility management, plant engineering, environmental compliance, sustainable energy and renewable energy technologies. Energy engineering is one of the more recent engineering disciplines to emerge. Energy engineering combines knowledge from the fields of physics, math, and chemistry with economic and environmental engineering practices. Energy engineers apply their skills to increase efficiency and further develop renewable sources of energy. The main job of energy engineers is to find the most efficient and sustainable ways to operate buildings and manufacturing processes (Wikipedia).

Select four:

01:220:334 Energy Economics
14:332:402 Sustainable Energy
14:540:488 Design of Decision Support Systems
14:635:405 Solar Cell Design and Processing

7.2 Financial Systems Track

Financial Systems track provides ISE students with opportunities to build on financial related courses such as 33:10:310 Accounting for Engineers and 14:540:343 Engineering Economics to have a deeper knowledge in corporate finance, investment analysis and futures and options. It is designed for students who wish to work in industries such as securities, banking, and financial management and consulting, or general manufacturing and service firms.

Required:

33:390:300 Introduction to Financial Management (Fall, Spring, Summer) – the prerequisites for this course are Calculus I, Accounting for Engineers, and Engineering Statistics

Select three:

01:220:423 Advanced Time Series and Financial Econometrics
16:540:575 Advanced Engineering Economics I
33:390:380 Investment Analysis (Spring, Summer) – prerequisite is 33:390:300
33:390:400 Corporate Finance (Spring, Summer) – prerequisite is 33:390:300
33:390:420 Derivatives – prerequisite is 33:390:380

Special Permission Numbers for the ISE Financial Systems Track:

The process for obtaining a special permission number for the Rutgers Business School courses is that the ISE Undergraduate Director will verify that the ISE students have met the prerequisites for 33:390:300 (and 33:390:380 and 33:390:400 as well) and then send a confirmation e-mail to the Undergraduate Program Coordinator at the Rutgers Business School. The ISE students will then be advised to contact the Rutgers Business School Undergraduate Program Coordinator directly for the special permission #.

7.3 Manufacturing and Production Track

Manufacturing and Production uses workers and machines to transform raw material into products. It builds on the students' background in chemistry, physics, materials properties and mathematics toward the understanding and improvement of manufacturing materials, processes, and systems. In addition, it deals with production planning, control, job and machine scheduling and distribution systems. It prepares students for careers in production, manufacturing and distribution and logistics systems.

Select four:

14:540:485 Industrial Information Systems
14:150:330 Introduction to Nanomaterials Science and Engineering
16:540:520 Supply Chain and Logistics Engineering (Requires 3.0 GPA)
Or 33:799:301 Introduction to Supply Chain Management
14:650:388 Computer-Aided Design in Mechanical and Aerospace Engineering

7.4 Quality and Reliability Track

Quality and Reliability deals with ensuring that the quality of products and services achieves a target quality level by assessing the quality performance indicators and monitoring and improving the processes during production and in field use. It also provides fundamentals of reliability for product and system design. In-depth education in reliability engineering, system resilience, condition based maintenance, software reliability and warranty policy is provided. It prepares students for careers in system engineering enterprises and corporations and in production and manufacturing systems.

Select four:

01:960:490 Introduction to Experimental Design
01:960:463 Regression Methods
14:540:491/492 Introduction to Reliability
16:540:507 Data Analytics in Engineering Systems
16:540:580 Quality Management
17:610:560 Foundations of Data Science

8. UNDERGRADUATE COURSE DESCRIPTIONS

Note: M denotes course is included in major average

14:540:201 Work Design and Ergonomics (3M)
Corequisite: 14:540:202, Prerequisite: (01:640:151 or 01:640:191 or 21:640:135 or 50:640:121)
Man-machine analysis, motion economy, time study, predetermined time systems, work sampling; introduction to robotics, facilities layout, material handling; introduction to ergonomics and anthropometric, biomechanical, and human-machine interface models.

14:540:202 Work Design and Ergonomics Laboratory (1M)
Corequisite: 14:540:201, Prerequisite: (01:640:151 or 01:640:191 or 21:640:135 or 50:640:121)
Experiments in robotics, time study, work measurement, workplace design and the human-machine interface, facilities layout.

14:540:210 Engineering Probability (3M)
Prerequisite: (01:640:152 or 01:640192 or 21:640:136 or 50:640:122)
Probability problems in engineering, conditional probability, discrete and continuous distributions, functions of random variables, interval estimates.

14:540:213 Industrial Engineering Laboratory (2M)
Prerequisite: (01:640:151 or 01:640:191 or 21:640:135 or 50:640:121) AND (14:440:127)
Introduction to programming, fundamental data types, flow control, and function; arrays, pointers, and do loops; algorithms and flow charts; GUI concepts.

14:540:303 Manufacturing Processes (3M)
Corequisite: 14:540:304, Prerequisite: 14:635:407
Properties of engineering materials; metals, polymers, ceramics and composites, bulk and sheet forming, traditional and non-traditional material removal processes, polymer processing, laser and energy-beam processes, additive layered manufacturing processes and micro/nano fabrication processes. Basic and computerized machine tools. Process chains, planning and process optimization. Engineering metrology and product quality.

14:540:304 Manufacturing Process Laboratory (1M)
Corequisite: 14:540:303, Prerequisite: 14:635:407
Experiments on machine tools: lathes, drilling machines, milling machines, and CNC milling machines; robot workplace design and computer control of machine tools.

14:540:305,306 Honor Candidacy Problems (0,0)
Prerequisite: Permission of departmental chairperson. Prerequisite for industrial engineering students who wish to be James J. Slade Scholars.
Extensive reading and study in a particular problem area of industrial engineering under the guidance of a faculty member.

14:540:311 Deterministic Models in Operations Research (3M)
Prerequisite: (01:640:244 or 21:640:314 or 50:640:314)
Elements of modeling and problem solving. Use of a software package like LINDO, EXCEL to solve real life industrial engineering problems. Linear programming, duality, sensitivity analysis, integer programming, transportation and assignment problems.

14:540:320 Engineering Statistics (3M)
Prerequisite: 14:540:210
Statistical estimation; confidence interval; testing hypothesis; engineering applications throughout the course.

14:540:338 Probability Models in Operations Research (3M)
Prerequisite: (14:540:210) AND (01:640:244 or 21:640:314 or 50:640:314)
Modeling and decision making under uncertainty. Markov chains, Poisson processes, inventory models and queueing systems.

14:540:343 Engineering Economics (3)
Economic decisions involving engineering alternatives, annual cost, present worth, rate of return, and benefit-to-cost; before and after-tax replacement economy; organizational financing; break-even charts; unit and minimum-cost public sector studies.

14:540:382 Automation and Systems Design (3M)
Corequisite: 14:540:383, Prerequisite: (01:640:244 or 21:640:314 or 50:640:314) AND (01:750:227)
Programmable automation applied to manufacturing. Computer architecture, sensors and automatic data acquisition, computer control of actuators, continuous and discrete control of processes, computer integration, and local area networks.

14:540:383 Automation and Systems Design Laboratory (1M)
Corequisite: 14:540:382, Prerequisite: (01:640:244 or 21:640:314 or 50:640:314) AND (01:750:227)
Use of microcomputers and industrial controllers in controlling machines and processes. Assembly language programming, ladder logic programming, and interfacing controllers to sensors and actuators. Experiments in manufacturing applications.

14:540:384 Simulation Models in Industrial Engineering (3M)
Prerequisite: 14:540:338
Modeling and analysis of industrial and service systems using ARENA, simulation modeling perspectives, discrete event and continuous simulation, simulation languages, statistical aspects of simulation.

14:540:399 Design of Engineering Systems I (3M)
Prerequisites: (14:540:338) AND (14:540:382) AND (14:540:383)
OPEN TO 540 STUDENTS ONLY
Design principles, material selection, design for assembly, design for manufacturing, and effect of environmental issues on product design.

14:540:400 Design of Engineering Systems II (3M)
Prerequisite: (14:540:303) AND (14:540:304) AND (14:540:384) AND (14:540:399)
OPEN TO 540 STUDENTS ONLY
A team approach to the redesign of a “real-life” product. Alternative engineering plans for improved designs will be developed and implemented. Both written and oral reports will be completed.

14:540:433 Quality Engineering (3M)
Corequisites: 14:540:434, Prerequisite: 14:540:320
Statistical methods for monitoring and improving product quality and decreasing variation. Factorial experiments, variables and attribute control charts, acceptance sampling, on- and off-line process controls.

14:540:434 Quality Engineering Laboratory (1M)
Corequisite: 14:540:433, Prerequisite: 14:540:320
Practical application of quality engineering methodologies, statistical software, gage studies, online process control, design of experiments to improve product design, industrial manufacturing processes, and system design.

14:540:453 Production Planning and Control (3M)
Prerequisites: (14:540:311) AND (14:540:338)
Coordination of activities of both manufacturing and service systems. Systems design; input and output; planning and scheduling. Decision-making problems employing mathematical techniques of linear programming. Sequencing jobs on machines and line balancing techniques.

14:540:461 Engineering Law (3M)
Open to Juniors and Seniors
Legal and ethical aspects of engineering; bids, awards, and negotiated contracts. Liabilities to the public and to employees, contract labor law. Contracts, patents, copyrights, trademarks, and engineering specifications.

14:540:462 Facilities Layout and Materials Handling (3M)
Prerequisite: (14:540:201) AND (14:540:202) AND (14:540:303) AND (14:540:304)
Fundamentals of the design, layout, and location of industrial and nonmanufacturing facilities. Selection of machines and material handling equipment and their efficient arrangement. Emphasis on quantitative methods. Warehouse layout. Facility location theory.

14:540:485 Industrial Information Systems (3M)
Prerequisite: 14:540:320
The course focuses on acquiring hands-on experience in the organization, modeling, and analysis of raw data to extract pertinent information and actionable insights for industrial and engineering systems. Covered topics include database management using structured query language programming, data processing, analysis, and modeling using statistical programming software, as well as the design and implementation of data science solutions and forecasting methods through project-based learning and case studies from manufacturing, materials engineering, and energy systems.

14:540:487 Energy Systems Modeling and Optimization (3M)
Prerequisite: (14:540:311)
This course addresses the design, analysis, modeling and optimization of selected energy systems (including conventional fossil fuels and renewable wind and solar). This course will provide the basis for applying mathematical modeling and optimization techniques in energy systems. A set of projects and case studies focused on modeling and optimization of a variety of energy systems will be assigned to students and discussed in details. The course will have hands on experience with data collection, experimentation, simulation and optimization tools as they apply to energy systems.

14:540:491, 492 Special Problems
Prerequisite: Permission of department
Studies in phases of industrial engineering of special interest.

14:540:496, 497 Co-op / Internship in Industrial Engineering (3,3)
Prerequisite: Permission of department, Graded Pass/No credit.
Intended to provide a capstone experience to the student's undergraduate studies by integrating prior course work into a working industrial engineering professional environment. Credits earned for the educational benefits of the experience.

9. STUDENT SOCIETIES

ALPHA PI MU

Alpha Pi Mu is the Industrial Engineering Honor Society. Both academic excellence and leadership in service activities is emphasized for membership. Scholarship opportunities are also available. Faculty Advisor: Dr. Hoang Pham

INSTITUTE FOR OPERATIONS RESEARCH AND THE MANAGEMENT SCIENCES (INFORMS)

The goal of the student chapter of INFORMS at Rutgers University is to encourage interest in Operations Research, Analytics, and the Management Sciences, through seminars, social events, and visits to companies actively using such quantitative techniques. The Chapter also provides a forum for sharing information about educational and research opportunities, internships, and summer job possibilities. Faculty Advisor: Dr. Ezzat

INSTITUTE OF INDUSTRIAL AND SYSTEMS ENGINEERS (IISE)

The student chapter of IISE at Rutgers University is committed to the promotion of the industrial engineering profession. Professional activities include plant tours, industry speakers, alumni night, technical paper contests, and an engineering outreach program. Social activities typically include picnics, Freshman night, and a holiday mixer. By joining this society, each student receives a complimentary copy of ISE magazine with dues payment. Faculty Advisor: Dr. Randy Reagan

SOCIETY OF MANUFACTURING ENGINEERS (SME)

The student chapter of SME at Rutgers University is committed to the promotion of manufacturing engineering. There are plant tours, industry speakers, professional development conferences, certification and scholarship opportunities. Social activities include joint picnics with IIE student chapter and meetings. Upon joining this society, each student receives a free subscription to Manufacturing Engineering with dues payment. Faculty Advisor: Dr. Randy Reagan.

TAU BETA PI

Tau Beta Pi is the National Engineering Honor Society. Academic excellence and service to the University community are stressed. Membership is open to juniors and seniors who rank near the very top in their respective classes. Faculty Advisor: Dr. Elsayed

10. ISE FACULTY

https://ise.rutgers.edu/staff-directory

11. DEPARTMENTAL FACILITIES

https://ise.rutgers.edu/research-laboratories-and-facilities