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The State University of New Jersey

Undergraduate Handbook: Department of Industrial & Systems Engineering

Academic Year 2022-2023

Updated 11/01/2022

RUTGERS

The State University of New Jersey

Department of industrial and Systems Engineering (ISE)

Welcome to ISE!

In today's complex and competitive world, industrial engineers are in great demand to design, improve, and operate integrated *systems* of people, materials, equipment, and energy. The industrial and systems engineering discipline applies fundamentals from the mathematical, physical, and engineering sciences to efficiently design and analyze large systems that serve industry and government both in manufacturing and service sectors.

The undergraduate industrial engineering program at Rutgers provides students with a broad engineering education along with specialization in the industrial engineering, manufacturing, financial and energy fields. We believe that a broad education is necessary to understand the impact of engineering solutions in a global/societal context. Academic strength in mathematics, physics, and basic engineering science is required. Specialization is offered in mathematical modeling, quality engineering and statistical techniques, computer-aided design, computer-aided manufacturing, simulation, manufacturing processes, engineering economics, production planning and control, design of engineering systems and information technology. Students have access to state-of-the-art laboratory facilities where hands-on instruction is emphasized in robotics, machine vision, manufacturing, automated material handling, quality engineering, electronic and sensor devices, simulation, and computer information systems.

The industrial engineering program focuses on classroom instruction fostered by learning in project-teams. These teams frequently formulate and find engineering solutions to real-world industry problems. The ability to communicate effectively is emphasized by having students provide both oral and written reports. The ISE faculty is dedicated to excellence in teaching, research, and professional service. They bring experience, real-life industrial problems, and enthusiasm to the classroom, setting a standard for students to follow in their professional careers. ISE graduates work in several areas including electronic, pharmaceutical, and other manufacturing; health services, transportation, distribution, and communication; and computers, finance, marketing, and management. Students pursue graduate studies in engineering and in business at leading institutions.

In addition, the department provides students with the opportunity to attain hands-on experiences in the ISE labs with work design, manufacturing processes; computer-controlled manufacturing systems, and quality engineering and statistics and simulation. Our labs include the Manufacturing Automation Lab, the Quality and Reliability Lab, the Microcomputer Lab, the Manufacturing Processes Lab, the Computer Control and Mechatronics Laboratory, the Design Laboratory and the Advanced Simulation Laboratory.

This handbook and other information about the Department of Industrial and Systems Engineering at Rutgers can be found on the web at http://ise.rutgers.edu**.** Our mailing address is Department of Industrial and Systems Engineering, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ 08854-8018; fax (732) 445-5467; telephone (848) 445-3654; email for the undergraduate director, Dr. Elin M. Wicks at elin.wicks@rutgers.edu

Once again, we welcome you to the Department of Industrial and Systems Engineering. If you have any questions regarding your undergraduate program please feel free to stop by the departmental office. We are always available to help.

Enjoy Your Studies,

Dr. Mohsen Jafari, Chairman, CoRE 201
Dr. Elin M. Wicks, Undergraduate Director, CoRE 210
Ms. Laura Kasica, CoRE 201

IMPORTANT REMINDERS

1. You must follow the course requirements listed in the ISE Undergraduate Handbook (http://ise.rutgers.edu). As stated in the Handbook, "Each student must be aware that he or she is ultimately the person responsible for completing the BS degree requirements." Also, your official IE curriculum checklist is being maintained in Degree Navigator. You should periodically check on it, especially if you are close to graduation.

2. Prerequisite knowledge for a course is important to help you succeed. Prerequisite overrides are **not** automatically granted and are based on consultations with the course instructor and the ISE Undergraduate Director on a case-by-case basis.

3. **Co-Ops:** If you are planning a co-op, be sure to make an appointment to meet with Undergraduate Director.

4. **STUDY ABROAD:** If you are planning a study abroad, be sure to make an appointment with the Undergraduate Director for discussion and approval.

5. **LABS:** Labs are co-requisites in most IE courses. If you register for the course, you must register for the lab.

6. Should you require a Special Permission Number (SPN), you will need to meet with the Undergraduate Director. Adhering to the curriculum as given in the ISE Handbook will eliminate the need for SPN.

7. **Dept/Tech (D/T) electives:** Acceptable List A and List B electives are listed in the ISE Handbook. No exceptions will be made.

8. Make sure you consult the list of acceptable humanities/social science electives maintained by the Deans office.

Dr. Elin Wicks, ISE Undergraduate Director
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E-mail: *elin.wicks@rutgers.edu*

(Just send an e-mail to make an appointment)

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		(17 cr. hrs.)			(18 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	14:440:127	Intro to Computers	3
01:750:123	Analytic Physics IA	2	14:440:221	Engr Mech-Statics	3
14:440:100	Intro to Engr	1	__:___:___	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
14:332:373	Elements of EE	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
14:332:402	Sustainable Energy	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
14:540:487 [1]	Energy Systems Modeling and Optimization
14:635:405 [1]	Solar Cell Design & Processing
14:540:491/492 [1]	Introduction to Reliability Engineering (3.2 GPA required)
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
16:540:575 [1]	Advanced Engineering Economics I
33:799:301 [1]	Intro. to Supply Chain Management
33:390:380 [3]	Investment Analysis (pre-req: 33:390:310)

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
14:540:487 [1]	Energy Systems Modeling and Optimization
14:540:496 [1]	Co-Op 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.

5.3. Study Abroad

There are several universities abroad that are suitable for engineering students. Opportunities exist for students to study at schools in Australia, the United Kingdom, Ireland, Germany, Argentina, Chile, France, China, Spain, Japan, Mexico, Israel, Turkey and South Korea. It is possible to create a program of study such that a student will not lose time in finishing ISE degree requirements. It is not a straightforward transfer of credit though. For information see Dean Ciervo and the ISE Undergraduate Director. More information is available from the Rutgers Study Abroad Office at https://global.rutgers.edu/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. Four Year and One Semester Co-Op Option

All ISE students interested in pursuing the ISE co-op, must schedule a meeting with the ISE Undergraduate Director.

The co-op program is designed to provide a practical engineering experience to the student's undergraduate education by integrating prior course work into a working engineering environment. It presents a unique opportunity to the student to practice and/or apply knowledge and skills in various industrial and systems engineering environments. The credits earned are for the educational benefits of the experience. **Students may use 3 of the 6 co-op credits as Dept/Tech Elec upon approval of the ISE Undergraduate Director.**

Prerequisite: The normal prerequisite is 90 credits completed with a cumulative grade point average of at least 2.5. Students may be approved with slightly fewer credits at the discretion of the Undergraduate Director.

The co-op internship must be with the same company for six consecutive months, normally the spring and the summer semester.

Note that the 6 credits shown on page 10 are in addition to the 129 credit hours required for graduation unless the student is approved to use 3 credits as a Dept/Tech elective. Students who choose the co-op internship option will normally require 9 (or more) semesters to complete their undergraduate degree requirements.

The following are the requirements to satisfy an internship or co-op for 3 credits. To receive credit the students **must** follow these steps (no credits will be given if they are not followed). The credits will be used as a Departmental Technical Elective.

1. A written proposal must be submitted to the Undergraduate Director of the ISE Department by the student. The proposal must be approved by the Undergraduate Director. The written proposal should include the offer letter from the company, educational benefits, engineering related responsibilities at the work site, project tasks, and the plan for evaluation.

2. The student must have a faculty advisor (check with all faculty members about their interest in overseeing the internship or co-op) who agrees to oversee the work on a weekly basis by meeting with the student and reviewing a weekly report prepared by the student. The faculty and student must notify the Undergraduate Director of the arrangement.
3. A copy of the final report should be provided (after review by the faculty) to the Undergraduate Director.
4. The registration is by special permission only, obtained from the Undergraduate Director.
5. Students hired as technicians within the Department cannot use this to fulfill the Co-op / Internship requirement.

ISE Curriculum (Co-op Option)

If you plan to pursue a co-op, it is important that you make an appointment with the ISE Undergraduate Director, prior to the start of your co-op to discuss implementation details. All ISE co-ops must be approved by the ISE Undergraduate Director.

Freshman Year		(17 cr. hrs.)			(18 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	14:440:127	Intro to Computers	3
01:750:123	Analytic Physics IA	2	14:440:221	Engr Mech-Statics	3
14:440:100	Intro to Engr	1	__:___:___	Hum/Soc Elective	3
__:___:___	Hum/Soc Elective	3			

Sophomore Year		(17 cr. hrs.)			(16 cr. hrs.)
01:640:251	Multivar Calc	4	__:___:___	Dpt/Tech Elec (List B)	3M
01:750:227	Analytic Phys IIA	3	01:640:244	Diff Eqns Eng & Ph	4
01:750:229	Anal Phys II Lab	1	14:440:222	Engr Mech-Dyn.	3M
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			
14:540:213	IE Lab	2M			

Junior Year		(17 cr. hrs.)	
14:540:320	Eng Statistic	3M	
14:180:215	Eng Graphics	1M	
14:332:373	Elements of EE	3M	CO-OP – 6 Credits
14:635:407	Mech Prop Materials	3M	Spring and Summer
14:540:338	Prob Models in OR	3M	
14:540:382	Automation	3M	
14:540:383	Automation Lab	1M	

Fourth Year		(16 cr. hrs.)			(16 cr. hrs.)
14:540:343	Eng Economics	3	14:540:303	Mfg Processes	3M
14:540:433	Quality Eng & Stat	3M	14:540:304	Mfg. Processes Lab	1M
14:540:434	Quality Eng Lab	1M	14:540:311	Deter Models in OR	3M
__:___:___	Dpt/Tech Elec (List A)	3M	14:540:384	Simulat Models IE	3M
__:___:___	Dpt/Tech Elec (List B)	3M	14:540:399	Design of Eng Sys I	3M
__:___:___	Hum/Soc Elective	3	14:540:462	Fac Layout & MH	3M

Fifth Year		(12 cr. hrs.)
14:540:400	Design of Eng Syst II	3M
14:540:453	Prod Plan & Control	3M
14:332:402	Sustainable Energy	3M
__:___:___	Hum/Soc Elective	3

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

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 THAT HE OR SHE IS 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.

Please refer to this link: http://soe.rutgers.edu/oas/add_drop

6.4. Course Substitution

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

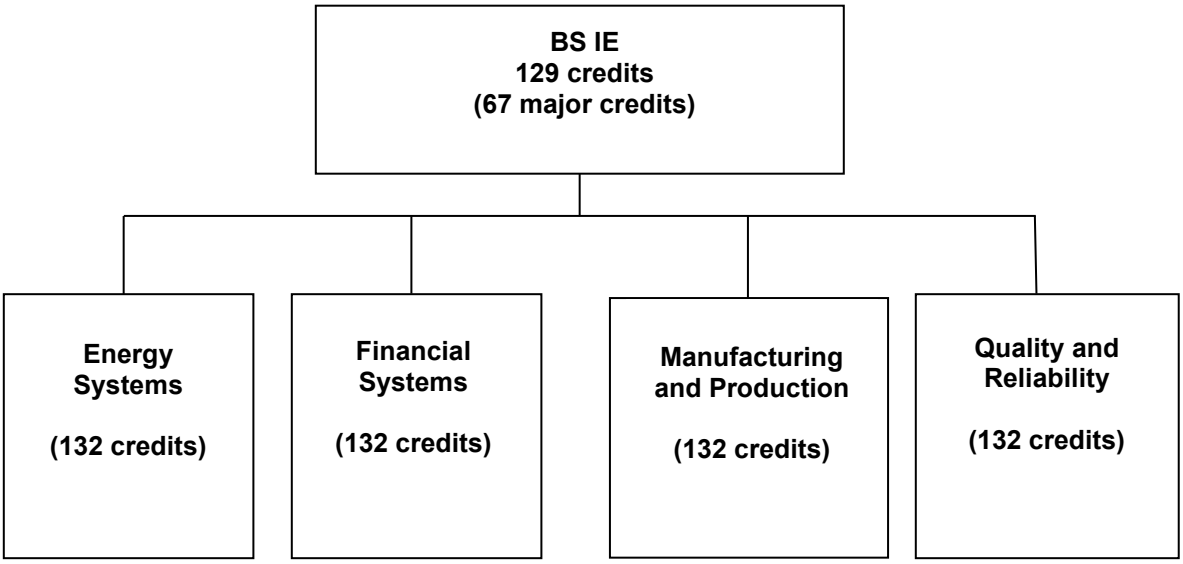
6.5. Academic Dishonesty

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
14:540:487 Energy Systems Modeling and Optimization
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. The following are the track courses.

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

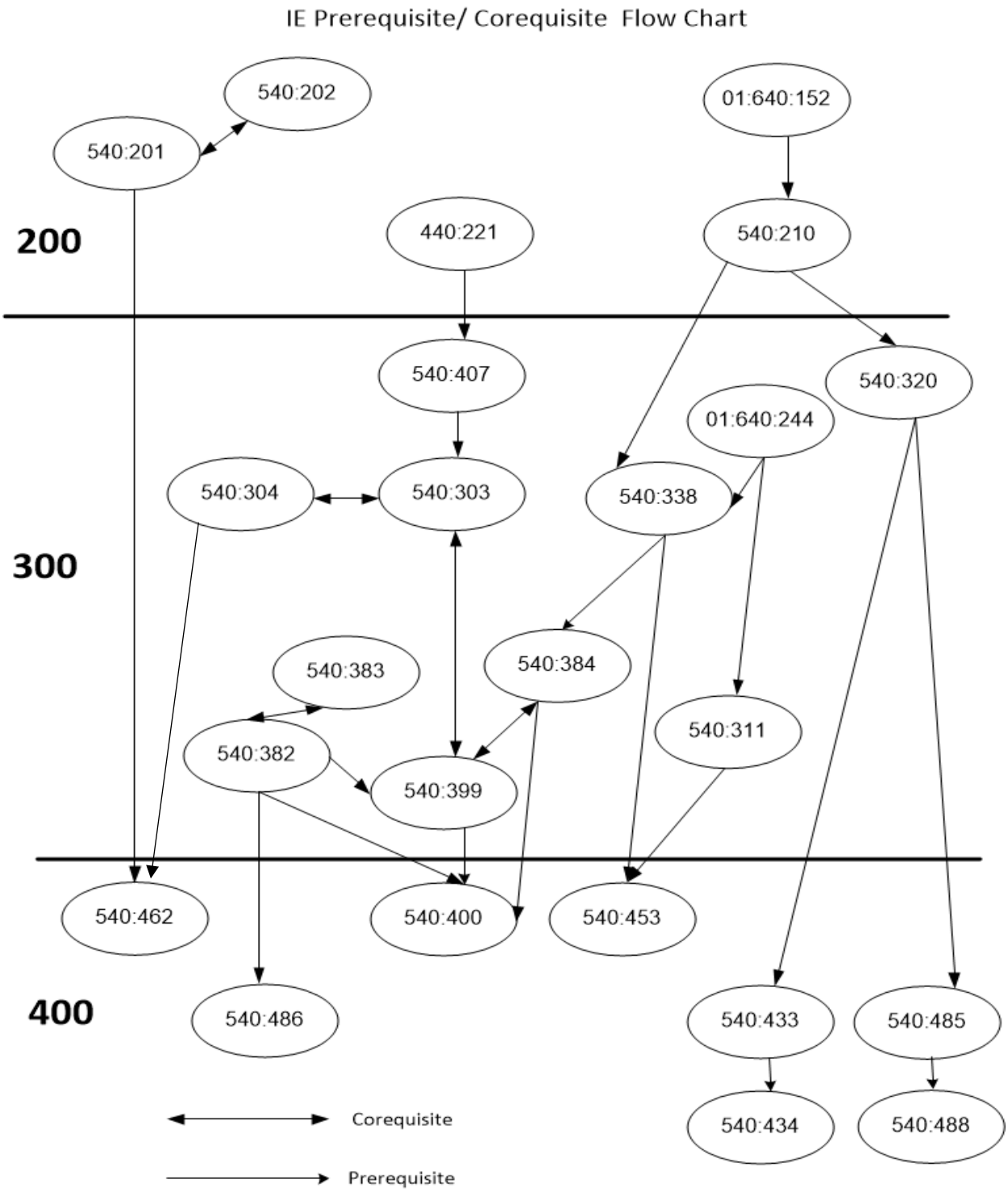
7.4 Quality and Reliability Track

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. ISE PREREQUISITE/COREQUISITE FLOW



9. 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) AND (14:332:402)
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 and granted only for a continuous, six-month, full-time assignment.

10. 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. Wicks

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.

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

11. ISE FACULTY

Melike Baykal-Gürsoy is a Professor and the Director of Laboratory for Stochastic Systems, and of GRIST-Game Research for Infrastructure SecuriTy Lab, in the department of Industrial and Systems Engineering at Rutgers University. She received her BS in Electrical Engineering and her MS in Electrical Engineering with a major in Control from Bogazici University, Istanbul, Turkey. Dr. Baykal-Gürsoy received her doctorate in Systems Engineering from the University of Pennsylvania, Philadelphia. Her specific fields of interest include stochastic modeling, queueing, Markov decision processes, stochastic games, and their applications. The current research in the Laboratory for Stochastic Systems focuses on the areas of modeling, optimization and control of stochastic systems, such as transportation and production/inventory networks. In GRIST Lab, Dr. Baykal-Gürsoy and her team are developing game-theoretic models and algorithms in order to protect infrastructure networks and their users against adversaries. Her research and teaching have been supported through grants from NSF, United Nations, DOD, and Transportation Coordinating Council/Federal Transit Administration. Dr. Baykal-Gürsoy is the co-author of a book entitled "An Introduction to Probability and Statistics."

David W. Coit is a Professor, he received his BS in Mechanical Engineering from Cornell University, an MBA from Rensselaer Polytechnic Institute, and MS and PhD degrees in Industrial Engineering from the University of Pittsburgh. His research interests are in the areas of reliability, optimization and energy systems modeling. In 1999, he was awarded a CAREER grant from the NSF to develop reliability optimization strategies that consider reliability estimation uncertainty. Previously, he worked for twelve years at IIT Research Institute (IITRI), Rome, NY, where he was a reliability engineer and project manager, and then later, the Manager of Engineering at IITRI's Assurance Technology Center. He is a member of IIE, INFORMS.

E. A. Elsayed is Distinguished Professor of the Department of Industrial and Systems Engineering, Rutgers University. He served as Chairman of the Industrial and Systems Engineering, Rutgers University, from 1983 to 2001 and Interim Chair 2013-2014. He is also the Director of the NSF/ Industry/ University Co-operative Research Center for Quality and Reliability Engineering. His research interests are in the areas of quality and reliability engineering and Production Planning and Control. He is a co-author of Quality Engineering in Production Systems, McGraw Hill Book Company, 1989. He is also the author of Reliability Engineering, Addison-Wesley, 1996. These two books received the 1990 and 1997 IIE Joint Publishers Book-of-the-Year Award respectively. His recent book Reliability Engineering 2nd Edition, Wiley, 2012 received the 2013 Outstanding IIE Publication.

Dr. Elsayed is also a co-author of Analysis and Control of Production Systems, Prentice-Hall, 2nd Edition, 1994. His research has been funded by the DoD, FAA, NSF, Defense Logistics Agency and many industrial companies including Lockheed Martin and Cummins Filtration. Dr. Elsayed has been a consultant for AT&T Bell Laboratories, Ingersoll-Rand, Johnson & Johnson, Personal Products, AT&T Communications, BellCore and other companies. He served as a Member of the Panel on Theory and Applications of Reliability Growth Modeling to Defense Systems, National Research Council of National Academic. He also served as the Editor-in-Chief of the IIE Transactions and the Editor of the IIE Transactions on Quality and Reliability Engineering. Dr. Elsayed is the Editor of the

International Journal of Reliability, Quality and Safety Engineering. He serves on the editorial boards of several journals in different capacities. He served an external evaluator for many undergraduate and graduate programs.

Dr. Elsayed is a frequent keynote speaker in National and International Conferences and is the recipient of many awards including the Rutgers University Board of Trustees Award for Excellence in Research for the academic year 2015-2016, Golomski Award for the outstanding paper, several Best Paper awards, William Mong Distinguished Lecturers Award, David F. Baker Research Award of the Institute of Industrial and Systems Engineering for Research Contributions to the discipline, IISE (Institute of Industrial and Systems Engineering) Fellow Award, ASME (American Society of Mechanical Engineers) Fellow, INFORMS (Institute for Operations Research and Management Science) Fellow, Senior Fulbright Award and the Recipient of 2011 Thomas Alva Edison Award for US Patent 7,115,089 B2. Most recently, Dr. Elsayed was awarded the Doctor Honoris Causes from University of Agers, France in January 2018 for his achievements in the reliability engineering field.

Ahmed Aziz Ezzat is an Assistant Professor of Industrial & Systems Engineering at Rutgers University. He received his Ph.D. in Industrial and Systems Engineering at Texas A&M University in 2019, and his B.Sc. degree in Industrial and Management Engineering in Alexandria, Egypt, in 2013. His broad research interests are in the areas of data science, probabilistic forecasting, quality and reliability engineering, with a focus on renewable energy and industrial systems. Dr. Aziz Ezzat's work has been published in leading journals such as The Annals of Applied Statistics, Technometrics, IEEE Transactions on Sustainable Energy, among others. His awards include the 2022 IISE DAIS Teaching Award, the 2020 IIF-SAS® research award, the 2020 Rutgers OAT Teaching Award, the 2019 ISEN Outstanding Graduate Student at Texas A&M, and the IISE Sierleja Memorial Fellowship in 2014. At Rutgers, Dr. Aziz Ezzat leads the Renewables & Industrial Analytics (RIA) research group. The research and educational activities at RIA have been supported by several grants, including from the National Science Foundation (NSF), NJ Economic Development Authority, Institute of International Forecasters and SAS corporation, and the Rutgers Energy Institute. He is a member of IISE, IEEE-PES, and INFORMS.

Weihong "Grace" Guo is an Associate Professor in the Department of Industrial and Systems Engineering. She earned her B.S. degree in Industrial Engineering from Tsinghua University, China, in 2010 and her Ph.D. in Industrial & Operations Engineering from the University of Michigan, Ann Arbor, in 2015. At Rutgers ISE, Dr. Guo is the founding co-director of the Data Analytics & Process Insights Laboratory. Her research interests are in the areas of statistical quality control and process monitoring, data mining for manufacturing and healthcare systems modeling and improvement, and quality-oriented design and modeling of complex manufacturing systems. Her current research focuses on data fusion methods in the interface between applied statistics and system control/optimization. Her research has been funded by DOT, NJOHSP, and industry. Dr. Guo received the Outstanding Young Manufacturing Engineer Award from the Society of Manufacturing Engineers. She received the 1st place Best Paper Award at the 2018 ASME Manufacturing Science and Engineering Conference (MSEC), a 2nd place Best Paper Award at MSEC 2016, the Best Paper Award at the 11th International Conference on Frontiers of Design and Manufacturing, and the Wilson Prize for the Best Student Paper in Manufacturing from the University of Michigan. She was a finalist in IISE and INFORMS Best Paper Competitions. Her teaching interests include quality engineering, data analytics, and manufacturing systems. She is a member of IISE, INFORMS, and ASME.

Mohsen A. Jafari is a Professor of Industrial & Systems Engineering at Rutgers University. He has directed or co-directed a total of over $15.5M funding from various government agencies and industry, in areas of automation, system optimization, data modeling, information systems, and risk analysis. His research application areas include energy systems, manufacturing, transportation, and healthcare. His work has led to major technological advances and product development including, multi-material deposition in solid free form fabrication; decision support system for traffic safety (Plan4Safety); integrated closed loop approach to planning, operation and investment of energy systems; cyber risk assessment of power networks; building energy asset management (BEAM); and Berth Planning. He actively collaborates with universities and research institutes in the US and abroad. He has advised thirteen Ph.D. theses and nine postdoctoral & research fellows. Presently, he is advising additional ten Ph.D. theses focusing on energy systems, zero-net communities, risk analysis and process improvement in healthcare. He is a member of IEEE and was recipient of the IEEE excellence award

in service and research. He has been consultant to several fortune 500 companies, and national and international government agencies.

Myong K. (MK) Jeong is a Professor and Graduate Director in the Department of Industrial and Systems Engineering, RUTCOR (Rutgers Center for Operations Research), and DIMACS (Center for Discrete Mathematics and Theoretical Computer Science) at Rutgers University. Currently, he is the Director of Laboratory for Data Analytics and Process Insights. He received his BS in Industrial Engineering from Han Yang University, Seoul, Korea, in 1991, MS in Industrial Engineering from Korea Advanced Institute of Science and Technology, Taejon, Korea, in 1993, MS in Statistics from Georgia Institute of Technology, Atlanta, Georgia, in 2002, and Ph.D. in Industrial and Systems Engineering from Georgia Institute of Technology, Atlanta, Georgia, in 2004. He was formerly an Assistant Professor in the Department of Industrial and Information Engineering, the University of Tennessee, Knoxville. He worked as a senior researcher from 1993 to 1999 at the Electronics and Telecommunications Research Institute (ETRI).

He has focused on developing data mining and machine learning techniques for process monitoring and improvement. The applications include various industries such as gas/oil, semiconductor, transportation, bio-energy, computing, electronics, and automobile. He has published over 100 journal papers including *Technometrics, IEEE Transaction on Semiconductor Manufacturing, IEEE Transactions on Systems, Man, Cybernetics, Pattern Recognition Letters*, and *IIE Transaction on Quality and Reliability*. He received the Freund International Scholarship and the National Science Foundation (NSF) CAREER Award in 2002 and in 2007, respectively. His research has been supported by the National Science Foundation, National Transportation Research Center, United States Department of Agriculture, Qatar National Research Fund, Electronics and Telecommunications Research Institute, and various industries. He has been a consultant for Samsung Electronics, Intel, IBM Watson Research Lab., ETRI, KISTI, and other companies. He served as the President of Data Mining Society of INFORMS (Institute for Operations Research and Management Science). He served as an Associate Editor and Advisory Board Member of various journals including IEEE Transactions on Automation Science and Engineering, International Journal of Quality, Statistics and Reliability, and International Journal of Advanced Manufacturing Technology. He is a senior member of IEEE.

Tuğrul Özel is a Professor in the Department of Industrial and Systems Engineering at Rutgers and the Director of Manufacturing and Automation Research Laboratory (MARLAB). He received his Ph.D. degree from Ohio State University in 1998. His research programs focus on advanced manufacturing, smart manufacturing, AI and machine learning applications in manufacturing automation, additive manufacturing, precision machining, laser materials processing, physics-informed machine learning, computational modeling and optimization of advanced manufacturing processes, and development of innovative micro/nano devices, processes, and integrated manufacturing systems. He has established an internationally recognized research program in the precision machining and additive manufacturing of advanced materials including alloy steels, titanium, and nickel-based superalloys. He has published four edited books; Intelligent Machining (2009), Micromanufacturing: Design and Manufacturing of Micro-Products (2011), Biomedical Devices: Design, Prototyping and Manufacturing (2016), and Modern Manufacturing Processes (2020). He published over 175 peer-reviewed articles in leading engineering journals and conferences. His journal articles received high number of citations (over 10,000) and his current author h-index is 50 in Google Scholar database. He has been on the scientific committee of over 60 international conferences, chaired numerous conference sessions, delivered 70 conference presentations, and planetary papers. He recently delivered two Keynote papers in 70th CIRP General Assembly and 3rd International Conference on Industry 4.0 and Smart Manufacturing in 2021. He is the Editor-in-Chief of the International Journal of Mechatronics and Manufacturing Systems, Associate Editor of ASME Journal of Manufacturing Science and Engineering, Editorial Board Member of several other journals. His research has been well funded by the National Science Foundation, Department of Commerce-NIST, TK Tribology Research Foundation NASA/New Jersey Space Grant Consortium, and industry. He has graduated 6 Ph.D. and 22 Masters students, and supervised 20 visiting PhD or Master's students, and 15 Aresty Research assistants, and many undergraduate student projects in these research areas. He is a senior member of SME (Society of Manufacturing Engineers), ASME (American Society of Mechanical Engineers), ASTM International and former Associate Member of CIRP-International Academy for Production Engineering.

Hoang Pham is a Distinguished Professor and former Chairman (2007-2013) of the Department of Industrial and Systems Engineering at Rutgers University. Before joining Rutgers, he was a Senior

Engineering Specialist with the Idaho National Engineering Laboratory and Boeing Company, Seattle. His research areas include reliability modeling of systems with competing risks and random environments, software reliability, and statistical inference. He is editor-in-chief of the International Journal of Reliability, Quality and Safety Engineering and editor of Springer Series in Reliability Engineering and has been conference chair and program chair of over 40 international conferences and workshops. Dr. Pham is the author or coauthor of 7 books and has published over 200 journal articles, 100 conference papers, and edited 20 books including Springer Handbook in Engineering Statistics and Handbook in Reliability Engineering. He has delivered over 40 invited keynote and plenary speeches at many international conferences and institutions. His numerous awards include the 2009 IEEE Reliability Society Engineer of the Year Award. Dr. Pham is a Fellow of the IEEE, AAIA, and IISE.

Randy A. Reagan is an Assistant Teaching Professor in the Department of Industrial and Systems Engineering. He earned a B.S. in Mechanical Engineering from the New Jersey Institute of Technology, an M.S. in Mechanical Engineering from the University of Michigan and an M.B.A. from New York University. He received his Ph.D. in Industrial Engineering from the New Jersey Institute of Technology where his research focused on resource assignment in short life technology-intensive new product development. He has more than 30 years of industry experience where he led teams that developed and launched over 500 new products. Dr. Reagan has been awarded 90 patents for design innovation.

Elin M. Wicks is an Assistant Teaching Professor and Undergraduate Director in the Department of Industrial and Systems Engineering. She earned a B.S. and M.S. in Industrial Engineering from Rutgers University where her masters research focused on a method for quantifying non-economic factors in monetary terms. She went on to earn her Ph.D. in Industrial and Systems Engineering from Virginia Tech focusing on the design of cellular manufacturing systems. She is an author of the well-known textbook, *Engineering Economy*, currently in its 17th Edition. She has been a contributing co-author of this text since the publication of the 10th edition.

Zhimin Xi is an Associate Professor in the Department of Industrial and Systems Engineering at the Rutgers University – New Brunswick. He received his B.S. and M.S. degree in Mechanical Engineering at the University of Science and Technology Beijing in 2001 and 2004, respectively. He obtained his Ph.D. in Mechanical Engineering (Program of Reliability Engineering) at the University of Maryland – College Park in 2010. His research interests are design for reliability and the applications for reliable autonomous vehicles/robots, lithium-ion batteries, and additive manufacturing. He has published more than 80 papers in prestigious journals and peer-reviewed conference proceedings. His research has been supported by National Science Foundation, DARPA, Department of Energy, Ford Motor Company, Denso North American Foundation, and The Woodbridge Group. He is a member of IISE, ASME, and IEEE. He is the recipient of 2021 ASME – Design Automation Young Investigator Award, 2020 Journal of Mechanical Design - Reviewer with Distinction Award, 2019 Rutgers A. Walter Tyson Assistant Professorship Award, 2016 DARPA - Young Faculty Award. He is the winners of multiple (including twice Top 10) Best Paper Awards from ASME – Design Automation Conference in 2008, 2011, 2013, and 2015 respectively. He serves as an Associate Editor for IEEE Robotics and Automation Letters.

Farzad Yousefian is an Assistant Professor in the Department of Industrial and Systems Engineering at Rutgers University. He received his Ph.D. in Industrial Engineering from the University of Illinois at Urbana-Champaign in 2013. He obtained his B.Sc. and M.Sc. degrees in Industrial Engineering from Sharif University of Technology in 2006 and 2008, respectively. Prior to joining Rutgers, he was an Assistant Professor from 2015 to 2021 and a tenured Associate Professor from 2021 to 2022 at Oklahoma State University (OSU). His research interest lies in distributed optimization in multi-agent networks, stochastic and large-scale optimization, nonconvex optimization, hierarchical optimization, variational inequalities, computational game theory, and applications in machine learning and transportation systems. He is a recipient of the National Science Foundation (NSF) Faculty Early Career Development (CAREER) award in 2020. He is also a recipient (jointly with his co-authors) of the Best Theoretical Paper Award at the 2013 Winter Simulation Conference (WSC). His research has appeared in journals such as SIAM Journal on Optimization, Mathematical Programming, Mathematics of Operations Research, IEEE Transactions on Automatic Control, and Automatica. His teaching has been recognized through the 2020 OSU College of Engineering, Architecture, and Technology Excellent Teacher Award. He is a member of INFORMS, SIAM, MOS, and IEEE.

12. DEPARTMENTAL FACILITIES

Advanced Simulation Laboratory. This laboratory is intended to serve student term projects in the areas of simulation, design, statistical modeling and machine learning. With access to large screens, fast computers and different media tools the students are able to analyze and simulate large volume of data and build models using R, Python, MATLAB, ARENA, LINDO, and other commercial tools. The lab also includes 3D modeling tools such as Solid-Works and FactoryTalk for student projects. There is also an PLC server that can be connected to remote devices and robots for real time motion and supervisory controls, and for cyber-physical systems controls. This PLC is usually used in two or three student design projects every year.

Automation Laboratory. This laboratory provides students with the opportunity to explore and learn about modern manufacturing automation and production processes. The laboratory is equipped with state-of-the-art equipment in CAD/CAM (Computer Aided Design and Computer Aided Manufacturing) and computer integrated manufacturing automation systems. It includes production type Computer Numerical Controlled (CNC) milling machines, CNC lathes equipped with force dynamometers and acoustic emission sensors, a mini-CNC high speed milling machine tool, laser micro-machining station, an innovative and automated sheet folding machine, Universal MTS testing machine for the assessment of material properties, fatigue life, and an Inston Impact tester for impact properties, an automated storage and retrieval system, programmable logic controllers and programmable mobile platforms, a material handling carousel, and a robotic assembly cyber-physical work station.

Automation and Mechatronics Laboratory. This laboratory provides students with hands on experience in motion and supervisory controls. With WiFi connection to the ISE remote PLC and host of PLCs and instructional kits (with motors, sensors, I/O boards) in the lab where students are able to work on hands -on projects that involve control of devices, motors, actuators, and higher level supervisory controls. This lab is used primarily for the Automation and Systems Design course and its lab. The lab also includes a small scale physical simulation of IOT sensors and devices for student projects.

Design Laboratory. The ISE Department has shared space for ISE and MAE design projects. The shared space is intended to promote interdisciplinary design activities and will include primary tools that can be used for system assembly and testing, with remote access to other department resources. This lab is located in Richard Weeks Hall building (second floor).

Energy Lab. This lab has been developed to allow students to have hands-on experience on how Industrial & Systems Engineering concepts and methods in data analytics, reliability engineering, and efficiency/productivity analysis, can be used to improve the operation of energy systems. The laboratory has a wide array of energy-related equipment, ranging from renewable energy sensors (solar pyranometers, sun tracker, sky imager, etc.), a solar generation array, battery testing equipment, and a visual/thermal inspection drone. Building energy simulation software is also available for educational and research activities.

Manufacturing Processes Laboratory. This laboratory provides students with the opportunity to study and practice manufacturing processes by supporting experimental learning of the fundamentals and the techniques of manufacturing processes. Students can set up and operate machine tools, manufacture parts, measure process variables, and inspect manufactured parts. Student learning from lab experiences is integrated with prior and subsequent learning of other engineering topics such as engineering materials, process planning, and quality control. The laboratory includes modern facilities to demonstrate and explore examples of manual turning, milling, drilling, grinding, conversational Computer Numerical Controlled (CNC) turning and milling, plastic filament extrusion based 3-D printing machines, heat-treating, welding, and joining processes. The laboratory also includes a variety of modern metrology instruments for measurement of process variables and dimensional and surface quality of manufactured parts. The laboratory is used on a scheduled basis for the Manufacturing Processes (ISE 303/304) and Design of Engineering Systems (ISE 399/400) courses. It also acquired an array of 3-D printing machines that are frequently used in undergraduate courses and design projects. The equipment is also used to perform laboratory experiments in heat treatment, chip formation, tool life, cutting forces, temperature, chip metallurgy, and power consumption.

Quality and Reliability Engineering Laboratory. This lab has been developed to allow the students to have hands-on experience in actual methods for quality control and reliability engineering. A variety of software for control charts, sampling plans, and design of experiments is available. The laboratory has a wide array of metrology equipment such as digital calipers and micrometers, roundness measurement equipment, surface profilometers, and a coordinate measuring machine. It also has various materials testing equipment, a Rockwell hardness tester temperature chambers, vibration test stands, and failure analysis equipment such as voltage stressing equipment, and measuring microscopes. LABVIEW, Minitab, and STATGRAPHICS software are available for students' use.

13. GENERAL INFORMATION

School of Engineering

Peng Song: Associate Dean for Undergraduate Education, **peng.song@rutgers.edu**
Jesenia Cadena: Assistant Dean for First Year Students, **jesenia.cadena@rutgers.edu**
Robert Ciervo: Assistant Dean for Transfer Students, **robert.ciervo@rutgers.edu**
Jasmine Bundy: Transfer Academic Advisor, **jasmine.bundy@rutgers.edu**
Ilene Rosen: Associate Dean for Student Services, **ilrosen@rutgers.edu**

Scarlet Hub – Dr, Samuel Dewitt Proctor Hall, 65 Davidson Road, Busch Campus

Career Services – 106 Somerset Street, 4th Floor, College Avenue Campus
604 Bartholomew Rd, Busch Campus

Housing - On-Campus - Taylor Road, Busch Campus General Information, 445-2992;
Off-Campus - 445-7766

International Student Services - 180 College Avenue, College Avenue Campus

Employment Opportunities: Job announcements are posted on the ISE bulletin boards. Students are encouraged to make use of the Career Exploration and Success Office on Busch campus (https://careers.rutgers.edu/).

Bulletin Boards: In the hallways on the 1st and 2nd floors, there are bulletin boards, which list course changes, seminars, fellowships, and other miscellaneous notices.

Departmental Office: The Department of Industrial and Systems Engineering office is located on the second floor of the CORE Building (Room 201). The office has copies of most forms you might need and the staff working there can answer many questions. Office hours are 9:00-5:00 PM, Monday through Friday. Closed for lunch between 12:00 - 1:00 PM.

The Telephone Number for the Department of Industrial and Systems Engineering is (848) 445-3654 and the fax number is (848) 445-5467. The area code and prefix is (848) 445 for all telephones - the extensions are given below.

NAME	EXT	CORE	EMAIL
Coit, David	2033	214	coit@soe.rutgers.edu
Elsayed, Elsayed A.	3859	226	elsayed@soe.rutgers.edu
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Manufacturing Automation Lab	5480	116	
Manufacturing Processes Lab	5480	112	
Advanced Simulation Lab	5480	106	
Quality & Reliability Lab	5480	114	
Automation & Mechatronics Lab	5480	602	
Design Lab		Richard Weeks Hall	
Engergy Lab		Richard Weeks Hall	
IE Conference Room	8555	203	

14. SECURITY AND SAFETY

Providing a secure and safe environment for all is a top priority.

Emergency Phone Number: The number is 932-7111 for university police and emergency.

CORE Building Access: The door is open weekdays from 8 AM to 9 PM.

Access to First Floor IE Corridor: The door is open weekdays from 9-6 PM For your safety, the corridor is under camera surveillance.

Access to Labs: The labs are open from 8:30 AM to 4:30 PM.

DON'T LET STRANGERS IN: Don’t open the door for people who have no entry keys. Don't keep any door ajar by placing an object in front of it.

Laboratory Rules and Safety:

Refer to Design Specialist for lab specific rules.