RUTGERS

The State University of New Jersey

# Undergraduate Handbook: Industrial Engineering

Academic Year 2000-2001

# Industrial Engineering (IE) at Rutgers University

Welcome to IE!

In today' s complex and competitive world, industrial engineers are in ever greater demand to design, improve, and operate integrated *systems* of people, materials, equipment, and energy. The industrial 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 and manufacturing 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 undergraduate program focuses on classroom instruction fostered by learning in multi-disciplinary 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.

IE graduates contribute to a wide range of endeavors 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 management at leading institutions.

The IE faculty are 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.

## WELCOME TO INDUSTRIAL ENGINEERING!

We have carefully prepared this handbook for you. It contains information about the undergraduate program in Industrial Engineering (IE) at Rutgers. Here, you will find descriptions of the IE curriculum and electives. We've also enclosed information on academic policies, department facilities, faculty advisors, and student societies.

Currently, students in the classes of 2000/2001/2002/2003 require a total of 132 credit hours with major credit hours totaling 62. This change updates the curriculum and provides design-focused engineering education.

The Department of Industrial Engineering offers courses in a variety of areas including: work design and ergonomics, deterministic modeling, simulation modeling, probability modeling, manufacturing processes, design of engineering systems, facilities layout, production planning and control, and quality engineering and statistics.

In addition, the department gives the students the opportunity to attain hands-on experiences in the IE labs with work design, manufacturing processes, computer controlled manufacturing systems, and quality engineering and statistics. Our labs include the Automation and Computer Integrated Manufacturing Lab, the Quality and Reliability Lab, the Facilities and Layout Lab, the Manufacturing Information Systems Lab, the Microcomputer Lab, and the Manufacturing Processes Lab.

This handbook and other information about the Department of Industrial Engineering at Rutgers can be found on the web at **http://www.engr.rutgers.edu/~ie/.** Our mailing address is Department of Industrial Engineering, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ 08854-8018; fax (732) 445-5467; telephone (732) 445-3654; email for the undergraduate director, Dr. T. Boucher, is tboucher@rci.rutgers.edu.

Once again, we welcome you to the Department of Industrial Engineering. If you have any questions regarding your undergraduate study please feel free to stop by the departmental office. We are located in Room 201 of the CoRE Building. We are always available to help.

Enjoy Your Studies,

Dr. E. A. Elsayed, Chairman
Dr. T. Boucher, Undergraduate Director
Ms. Cynthia Ielmini

## 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 educational objectives of the Industrial Engineering Department at Rutgers University?

1. *To prepare students to apply their creativity in solving complex engineering design problems, to approach unstructured problems, to synthesize and design potential solutions and to evaluate the impact of their solutions in the broader context of the organization or society.*

2. *To train students to collect, analyze, and interpret data relevant to problems arising in the industrial engineering domain.*

3. *To provide students with analytical and computational skills to operate effectively within the industrial engineering domain through training in problem representation, abstraction, and validation.*

4. *To prepare students to function as professionals in the workplace by fostering their ability to form, facilitate, lead, coordinate, and participate in teams as well as understand organizational processes and behavior. To prepare students to effectively and convincingly present their solutions and to do so in the context of written, oral, and electronic media.*

5. *To provide students with the skills and ability to apply current technology to solve industrial problems.*

6. *To sensitize students to a need for and to provide an ability to accomplish life-long growth within the field/profession of industrial and systems engineering.*

## Table of Contents

# 1. CLASS OF 2000/2001/2002/2003

## 1.1. IE Curriculum for Class of 2000/2001/2002/2003

| **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 | 14:440:127 Intro to Computers | 3 |
| 01:355:101 Expository Writing | 3 | 01:640:152 Calc Math Phy Sci | 4 |
| 14:440:100 Intro to Engr | 1 | 14:440:221 Engr Mech-Statics | 3 |
| 01:640:151 Calc Math Phy Sci | 4 | 01:750:124 Analytic Physics I | 2 |
| 01:750:123 Analytic Physics I | 2 | __:___:___ Hum/Soc. Elective | 3 |
| __:___:___ Hum/Soc Elective | 3 | | |

| **Sophomore Year** | (16 cr. hrs.) | | (17 cr. hrs.) |
|---|---|---|---|
| 14:540:213 IE Lab | 1M | 14:180:243 Mech of Solids | 3M |
| 14:540:201 Work Des & Ergo | 3M | 14:540:210 Eng. Probability | 3M |
| 14:540:202 Work Des Lab | 1M | 01:640:244 Diff Eqns Eng & Ph | 4 |
| 01:220:200 Econ Prn & Prob | 3 | 14:440:222 Eng Mech-Dyn. | 3 |
| 01:640:251 Multivar Calc | 4 | 01:750:228 Analytic Physics IIB | 3 |
| 01:750:227 Analytic Phys IIA | 3 | 01:750:230 Anal Physics II Lab | 1 |
| 01:750:229 Anal Phys II Lab | 1 | | |

| **Junior Year** | (17 cr. hrs.) | | (16 cr. hrs.) |
|---|---|---|---|
| 14:540:343 Eng. Economics | 3M | 01:355:302 Sci & Tech Writing | 3 |
| 14:540:338 Prob. Models in OR | 3M | 14:540:384 Simulat. Models IE | 3M |
| 14:440:407 Mech. Prop Materials | 3M | 14:540:311 Deter. Models in OR | 3M |
| 14:332:373 Elements of EE | 3M | 14:540:303 Mfg. Processes | 3M |
| 14:540:382 Comp. Contr Mfg Sys | 3M | 14:540:304 Mfg. Processes Lab | 1M |
| 14:540:383 Comp. Contr Lab | 1M | 14:540:399 Design of Eng Syst I | 3M |
| 14:180:215 Eng. Graphics | 1 | | |

| **Senior Year** | (16 cr. hrs.) | | (15 cr. hrs.) |
|---|---|---|---|
| 14:540:453 Prod Plan & Control | 3M | 14:540:462 Fac Layout & MH | 3M |
| 14:540:433 Quality Eng & Stat | 3M | __:___:___ Dpt/Tech Elec (List A) | 3M |
| 14:540:434 Quality Eng. Lab | 1M | __:___:___ Dpt/Tech Elec (List B) | 3M |
| 14:540:400 Design of Eng Syst. II | 3M | __:___:___ Hum/Soc Elective | 3 |
| 33:010:310 Account for Eng. | 3M | __:___:___ General Elective | 3 |
| __:___:___ Hum/Soc Elective | 3 | | |

**M - Course is included in major average.**
**Total credit hours: 132.**
**Major credit hours total 62.**

**The Dept/Tech electives (List A & List B) for Class of 2000/2001/2002/2003 are given in Section 2.2., page 6 of this handbook.**

## 1.2 Departmental/Technical Electives-Class of 2000/2001/2002/2003

Class 2000 and beyond are required to take one course from the Departmental/Technical Electives List A (Design Elective) and one course from the Departmental/Technical Electives List B . These two lists are given below.

If a student has a particular interest, the advisor may approve courses not on the list. For example, a student planning to go to medical school may wish to take biology and organic chemistry. These are appropriate technical electives that do not appear on the list.

IE and other graduate courses are possible electives for students with a 3.0 major average or greater. Students must complete a form from the Undergraduate Director in order to take a graduate course. Note: This is a good practice for many students who are interested in pursuing graduate studies.

### List A - Design Electives

14:540:484 Design of a Manufacturing Enterprise
14:650:342 Design of Mechanical Components
14:650:455 Design of Mechanisms
03:975:316 Urban Design & Site Planning

### List B

14:540:485 Manufacturing Information Systems
14:540:461 Engineering Law
14:540:486 Automated Manufacturing Systems
14:540:487 Automated Manufacturing Systems Laboratory(co-requisite)
14:540:475 Introduction to Pharmaceutical Manufacturing
01:960:384 Intermediate Statistical Analysis
01:640:250 Introductory Linear Algebra
14:540:382 Manufacturing Processes & Materials for Engineers
14:540:282 Metal Processing
14:540:410 Linear Programming

## 2. ALL CLASSES - ACCEPTABLE HUMANITIES/SOCIAL SCIENCE ELECTIVES

### 2.1. Below is the list of acceptable electives. It should be noted that:

1. Students may take both Microeconomics and Macroeconomics to satisfy the required courses: Economics Principles and Problems AND a General Elective. Students who take macro (but not micro) will not satisfy the Economic Principles and Problems requirement.

2. At least two electives must be in one subject area to form a sequence. One of these must be at the 300 level or higher. One additional elective must be at the 300 level or higher.

**College Requirements:** All candidates for the B.S. degree must complete a minimum of 18 credits of humanities/social science courses including the following:

01:355:101;
01:220:200;
Four free electives chosen from courses listed below;
Free electives must be selected in a manner such that at least two courses are at the 300/400 (upper) level, at least two courses, including one upper-level, are from the same subject area; and at least two different subjects are represented.

**Questions or appeals regarding course acceptability should be directed to the Associate Dean.**

**Rationale for H/SS Electives in the Curriculum:** A good undergraduate education should provide more than the development of technical skills. Properly chosen, H/SS electives can complement your technical courses by helping you to develop an understanding of the problems facing our society, a historical consciousness, a sense of values, a knowledge of other cultures, an appreciation of the fine arts, and an ability to think logically and communicate effectively. Think seriously about your choices, and use them to enhance your educational experience. You might even wish to earn a minor. See the Associate Dean for details.

**013 AFRICAN LANGUAGES AND LITERATURES**
131,132,205,227,228,235,236,301,311,327,328.

**014 AFRICANA STUDIES**
All courses EXCEPT: 140,223,224,341,342,460,490 through 498.

**050 AMERICAN STUDIES**
All courses EXCEPT: 281,282,283,284,390,398,490.

**070 ANTHROPOLOGY**
All courses EXCEPT: 291,292,293,294,334,335,347,354,355,391-395,495-498.

**080 ART**
200,203,204,207-210,301,319,367,369,370,400,420,493.

**082 ART HISTORY**
All courses EXCEPT: 291,292,293,294,345,462,473,491 through 498.

**098 ASIAN STUDIES**
241,242,321,322,444.

**165 CHINESE**
All courses EXCEPT: 101,102,111,112,121,210,361,362,401,490 through 498.

**190 CLASSICS**
All courses EXCEPT: 101,102,309,431,432,491 through 496.

**195 COMPARATIVE LITERATURE**
All courses EXCEPT: 399,481 through 496.

**220 ECONOMICS**
All courses EXCEPT: 102,103,322,326,386,393,394,401-410,415,419,421,436-496.

**350 ENGLISH**
350-354, All courses

**420 FRENCH**
All courses EXCEPT: 101 through 121,171,210,275,299,493 through 498.

**450 GEOGRAPHY**
100,102,103,205,211,222,240,262,311,331,332,334-338,
341,342,361,363,370,380,405,411,470.

**470 GERMAN**
All courses EXCEPT: 101 through 122;
281,282,299,320,393-396.

**489 MODERN GREEK**
201,202,241,305,306,493,494.

**490 GREEK**
207,208,304,305,306,308-312,315,335,391,392,400,402.

**500 HEBRAIC STUDIES**
All courses EXCEPT: 101-104,299.

**506 HISTORY**
506-512 All courses

**535 HUNGARIAN**
201,202,259,260,321,355,360,460.

**556 INTERDISCIPLINARY STUDIES**
220,300,397.

**560 ITALIAN**
All courses EXCEPT: 101 through 124;
283,284,299,317,318,383,384.

.

**565 JAPANESE**
131,132,241,242,250,301,302,313,314,317,350,360,370,401,402,411,470,483.

**574 KOREAN**
131,132,301,302.

**667 MEDIEVAL STUDIES**
281,282,481.

**685 MIDDLE EASTERN STUDIES**
350,355,451,452,455.

**700 MUSIC**
100-122,203-222,226-238,301-322.
(For Music **ONLY** 200 and above counts as upper level).

**730 PHILOSOPHY**
All courses

**787 POLISH**
259,370,470,475,493,494.

**790 POLITICAL SCIENCE**
All courses EXCEPT: 250,251,300,392 through 400, 481 through 498.

**810 PORTUGUESE**
All courses EXCEPT: 101,102,301,302.

**830 PSYCHOLOGY**
101,201,211,246,271,272,301,303,305,307,311,315,321,326,
330,331,335,338,346,351-353,361-365,371-377,381,393,394,472.

**836 PUERTO RICAN & HISPANIC CARIBBEAN STUDIES**
All courses EXCEPT: 354,356,494-496.

**840 RELIGION**
All courses EXCEPT: 171 through 178.

**860 RUSSIAN**
All courses EXCEPT: 101,102,105,106,351,352, 491 through 497.

**861 SLAVIC & EASTERN EUROPEAN STUDIES**
259,264,360,370,391,455,460,470,475.

**920 SOCIOLOGY**
All courses

**940 SPANISH**
All courses EXCEPT: 100-
105,121,139,150,201,287,288,299,317,318,379,380,387,388,394,470 through 498.

**965 THEATRE ARTS**
211-214,311,312,343,398,400,401.

**975 URBAN STUDIES**
101,103,206,222,231,250,305,321,324,413,416,441,473,475,477,478,485.

**988 WOMENS STUDIES**
All courses.

## COOK COLLEGE COURSES

**372 ENVIRONMENTAL RESOURCES**
202,427.

**373 ENVIRONMENTAL & BUSINESS ECONOMICS**
361,363,381.

**374 ENVIRONMENTAL POLICY, INSTITUTIONS and BEHAVIOR**

101,102,175,211,220,223,269,279,301,308,312,313,314,315,322,331,
335,336,341.

**554 INTERDISCIPLINARY STUDIES**
228,301,305.

## 2.2. General Electives: List of Unacceptable General Electives

At the present time, the IE curriculum only requires **ONE** general elective. Students can take additional courses of their own choice on a voluntary basis.

**Note:** This list of unacceptable General Elective Courses is based on the current New Brunswick Undergraduate Catalog. Any new courses added after this publication of the catalog are subject to review.

**CHEMISTRY 01:160**
110 through 140

**COMPUTER SCIENCE 01:198**
110,170

**ENGLISH 01:355**
096 through 099

**EXERCISE SCIENCE 01:377**
171 through 180

**MATHEMATICS 01:640**
011 through 115

OR Any University Course with an "E" Credit Prefix.

## 3. ACADEMIC STANDING

**PROBATION: Do not take probation lightly.** Each semester, students' grades are reviewed. The IE policy is that students may be on academic probation for any of the following reasons: if the term average falls below 1.7 for sophomores, below 1.8 for both juniors and seniors; if the major average falls below 1.9 for students with 5 semesters, below 1.9 for students with 6 semesters, below 2.0 for students with 7 or more semesters; or the university average falls below 1.0.

**DISMISSAL:** If you have been on probation twice during your Rutgers Engineering career, you have no chances left. If your grades are such that you would be eligible for probation again, you will be dismissed. These do not have to be consecutive terms on probation. If you have been on probation twice, you will be dismissed unless you get off probation. **Do not take probation lightly.** In addition, a student may be dismissed if the term average falls below 1.4 or if the major average falls below 1.6 in semester 5, 1.8 in semester 6, and 1.9 in semester 7.

# 4. SUMMARY OF ACADEMIC PROGRAMS

## 4.1 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 a 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 IE 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 IE credits plus 30.

Some courses may satisfy both IE and liberal arts requirements. For example, an IE 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 IE credits plus thirty. If that occurs, the student must take additional courses to satisfy item (3) above.

## 4.2. 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.

## 4.3 Five Year MS/MBA Program

A joint program exists between The Graduate School of Management in Newark and the School of Engineering. A student can receive an MBA within 12 months of receiving the BS in engineering. Students should apply early in the junior year. Careful course scheduling is required to fit several business courses in the junior and senior years. To apply, students need a GPA of 3.0 or better and a rank in the top quartile in the GMAT.

## 4.4. Study Abroad

There are two programs that are suitable for Industrial Engineering students. The first program is at the City University of London. It is possible to create a program of study there such that a student will not lose time in finishing IE degree requirements. It is not a straightforward transfer of credit though. For information see Dean Bernath. The second is at Technion University in Israel. The courses match our IE courses. In addition, instruction is in English. For information, see Dr. Boucher.

# 5. ACADEMIC POLICIES

This handbook has been compiled for undergraduate Industrial 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 your folder. As you complete courses, the Dean's staff crosses the courses off the list. The folders are kept in the Dean's Office in the Engineering Building (Room B100). During registration periods the folders are given to the class advisor and students have the opportunity to see their folders.

Each class has a departmental faculty advisor as indicated on the list on page 32 of this handbook. Your advisor will post special office hours during registration periods. At other times during the semester, you may make an appointment with your advisor if the need arises. It is really sensible to make appointments (and appear on time) to save your own time. Faculty members are busy and have irregular schedules so it may be inefficient to just "stop by".

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 your advisor when off you run into academic or other problems. During registration, look at the check-list of courses in your folder to make sure your understanding of your status agrees with the view of the college. It is especially important for graduating seniors to check their folders 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 IE degree requirements, IE courses, Academic Policies and Procedures, and University Policies and Procedures.

## 5.1. Recent Changes in IE Curriculum

When the department or the college makes significant changes in the curriculum, these changes apply to entering students. For example, if you enter in the class of 2000, you are required to satisfy the requirements on the curriculum labeled 2001. If you are delayed and graduate in 2002, the 2001 curriculum still applies to you.

## 5.2. Major Average

The courses that are included in the major average are marked "M" on the IE 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.

When you register, be sure to put an "M" next to your Dept/Tech elective on the registration card. The computer system cannot keep track of all the possible Dept/Tech electives.

## 5.3. Courses Included In Major Average

**BIORESOURCE ENG.** (127/128/129)

All 127 courses except 127:100
All option required
All option electives
155:204, 303, 304, 308, 411
180:243, 318, 331, 345, 387, 389, 431
332:373, 375
375:405
400:201, 202, 402, 411, 419
460:101
530:211, 321
650:351
704:351
780:382
930:266

**APPLIED SCIENCE** (073)

All engineering electives
All technical electives
All math/science electives

**CERAMIC ENGINEERING** (150/151)

All 150 courses **except:**
150:201, 202, 205, 206, 270
271, and 150:
010:310
332:373, 375
440:407
460:301
540:343
630:301
960:401, 490
All technical electives
One 150 may be used to
satisfy one Dept/Tech

**CHEMICAL ENGINEERING** (155/156)

All 155 courses
115:301, 313
119:390
160:307, 308, 311, 323, 324
325, 341, 342
332:373
All technical electives

**CIVIL ENGINEERING** (180/181)

All 180 courses
440:407
All technical electives

**ELECTRICAL ENGINEERING** (332/331)

All 332 courses
All technical electives

**INDUSTRIAL ENGINEERING** (540/541)

All 540 courses
180:243
33:010:310
332:373
440:407

All technical electives

**MECHANICAL ENGINEERING** (650/651)

All 650 courses
332:373, 375
540:343
640:421
655:407

**Note: All departmental and technical electives must be approved by the student's advisor.**

## 5.4. 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.

You may withdraw from courses up to the 8th week without permission. Between the 8th and 12th weeks you may withdraw with the permission of Dean Bernath. If you are severely behind in your course work, you may get permission from the Dean. After the 12th week, permission from the Dean is required and your reason for withdrawal must be significant and beyond your control.

## 5.5. Course Substitution

There are no course substitutions for IE courses. If there is an excellent reason, with the permission of the advisor, students may substitute courses from other schools for electives or for required courses not given in the IE department. Please note, in particular, 01:960:379 will **not** be accepted in place of Engineering Probability, 14:540:210.

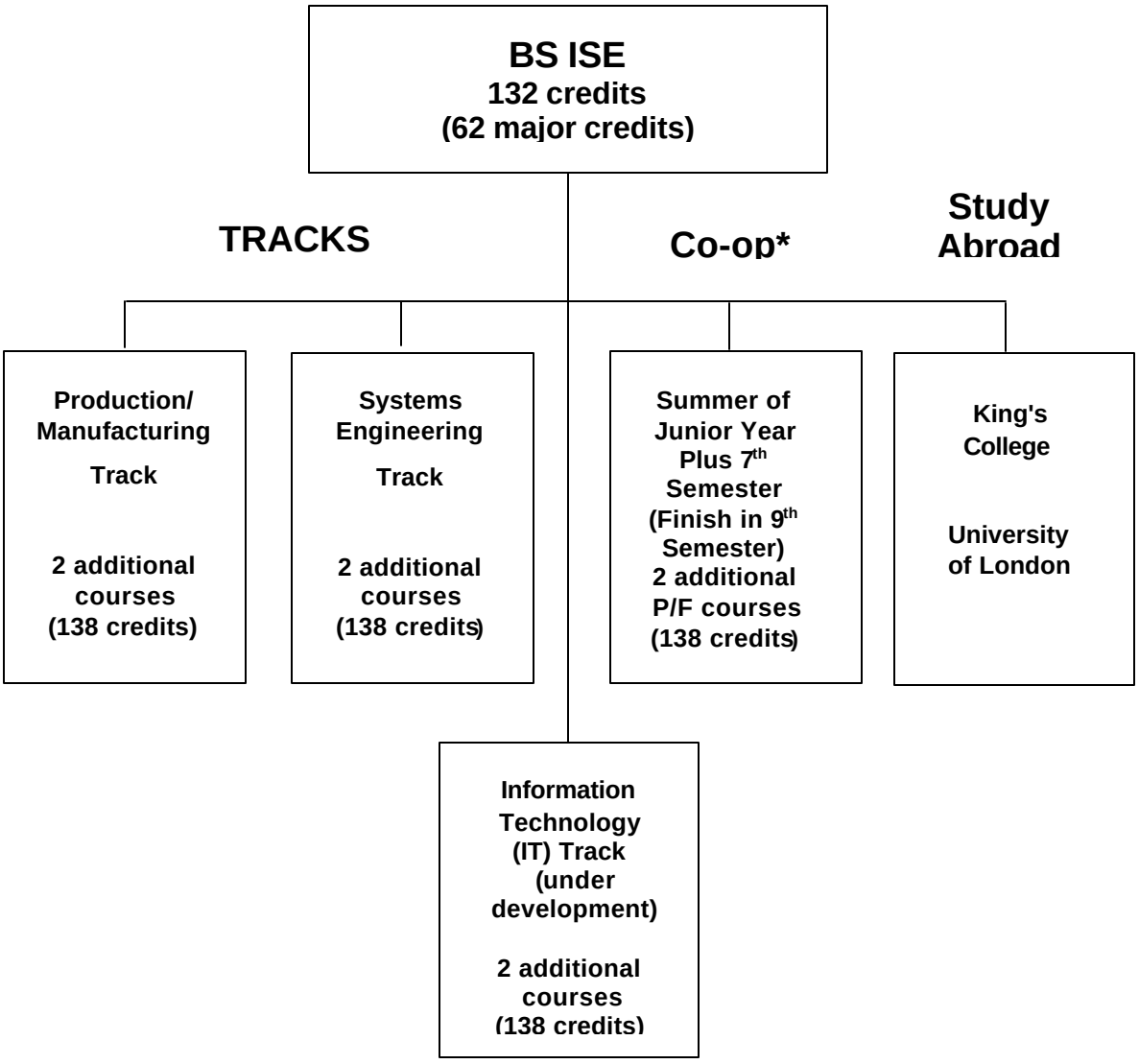
## 5.6 Academic Dishonesty

The Industrial Engineering Department expects each student to conduct him or herself in a professional manner. The policy of the IE Department is as follows: we do not hesitate to report offenses of cheating to the college 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 three violation. The recommended sanction is suspension from the university for one or more terms with a notation of academic disciplinary suspension placed on the student's transcript.

## 6. INDUSTRIAL ENGINEERING UNDERGRADUATE TRACKS

The IE program provides tracks that enable students to choose a specialization in order to emphasize areas of interest. There are five possible tracks:




### Curriculum Tracks

Additional opportunities exist for qualifying students regarding their progression through the BS IE curriculum. These include tracks in Production/Manufacturing, Systems Engineering, and Information Technology. Students must complete six additional course hours beyond the BS IE basic requirements. Students who complete the additional requirements receive their degrees with a certificate designating the appropriate track.

## Co-op in IE

The co-op internship provides the student with the opportunity to practice and/or apply knowledge and skills in various industrial and systems engineering environments. This co-op internship is intended to provide a practical engineering experience to the student's undergraduate education by integrating prior course work into a working engineering environment. In addition to receiving compensation for their on-site job experience, students earn credits for the educational benefits of the experience. The 6 co-op credits are in addition to the 132 credit hours required for graduation. Students who choose the co-op internship option will complete their undergraduate degree requirements in the 9$^{th}$ semester.

## Study Abroad

The Department is in the process of initiating a study abroad program with King's College, University of London for qualified students majoring in industrial engineering. Extensive study abroad programs in several countries are available to industrial engineering students through the Rutgers Study Abroad Office.

## Five Year BS/MBA Program

A special joint program offered by the School of Engineering and the Graduate School of Management is available for qualified industrial engineering students. The program offers the opportunity to obtain the Master of Business Administration degree within one calendar year of completing the baccalaureate degree requirements.

## Five Year Dual Degree Program

A five-year, dual-degree program offered by the School of Engineering is available to qualified industrial engineering students. This program is offered in cooperation with three liberal arts colleges in New Brunswick: Rutgers Douglass College, Rutgers Livingston College, and Rutgers College. This program leads to a Bachelor of Science degree in industrial engineering and a Bachelor of Arts degree from the cooperating liberal arts college in any major in which that college confers the BA degree.

## Production/Manufacturing Track

### List A (Select one)

14:540:484 Design of a Manufacturing Enterprise
14:650:342 Design of Mechanical Components
14:650:455 Design of Mechanisms

### List B (Select three)

14:540:485 Manufacturing Information Systems
14:540:461 Engineering Law
14:540:486 Automated Manufacturing Systems
14:540:487 Automated Manufacturing Systems Laboratory (co-requisite)
14:540:475 Introduction to Pharmaceutical Manufacturing
14:540:382 Manufacturing Processes and Materials for Engineers
14:540:242 Metal Processing

## Systems Engineering Track

### List A (Select one)

14:540:484 Design of a Manufacturing Enterprise
03:975:316 Urban Design and Site Planning

### List B (Select three)

14:540:485 Manufacturing Information Systems
14:540:461 Engineering Law
14:540:486 Automated Manufacturing Systems
14:540:487 Automated Manufacturing Systems Laboratory (co-requisite)
01:960:384 Intermediate Statistical Analysis
01:640:250 Introductory Linear Algebra
14:540:410 Linear Programming

## Information Technology Track

### List A (Select one)

14:540:XXX Design of Decision Support Systems
14:540:485 Manufacturing Information Systems

### List B (Select three)

14:540:485 Manufacturing Information Systems
01:198:336 Principles of Database Management Systems
01:198:352 Internet Technology
14:332:423 Telecommunications Networks
14:332:452 Introduction to Software Engineering
22:198:610 Electronic Commerce
22:630:615 Electronic Marketing
22:010:623 Enterprise Resource Planning

## IE Curriculum for Class of 2000/2001/2002/2003 (Coop Option)

| **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 | 14:440:127 Intro to Computers | 3 |
| 01:355:101 Expository Writing | 3 | 01:640:152 Calc Math Phy Sci | 4 |
| 14:440:100 Intro to Engr | 1 | 14:440:221 Engr Mech-Statics | 3 |
| 01:640:151 Calc Math Phy Sci | 4 | 01:750:124 Analytic Physics I | 2 |
| 01:750:123 Analytic Physics I | 2 | __:___:___ Hum/Soc Elective | 3 |
| __:___:___ Hum/Soc Elective | 3 | | |

| **Sophomore Year** | (16 cr. hrs.) | | (17 cr. hrs.) |
|---|---|---|---|
| 14:540:213 IE Lab | 1M | 14:180:243 Mech of Solids | 3M |
| 14:540:201 Work Des & Ergo | 3M | 14:540:210 Eng Probability | 3M |
| 14:540:202 Work Des Lab | 1M | 01:640:244 Diff Eqns Eng & Ph | 4 |
| 01:220:200 Econ Prn & Prob | 3 | 14:440:222 Eng Mech-Dyn | 3 |
| 01:640:251 Multivar Calc | 4 | 01:750:228 Analytic Physics IIB | 3 |
| 01:750:227 Analytic Phys IIA | 3 | 01:750:230 Anal Physics II Lab | 1 |
| 01:750:229 Anal Phys II Lab | 1 | | |

| **Junior Year** | (17 cr. hrs.) | |
|---|---|---|
| 14:540:343 Eng Economics | 3M | |
| 14:540:338 Prob Models in OR | 3M | |
| 14:440:407 Mech Prop Materials | 3M | |
| 14:332:373 Elements of EE | 3M | CO-OP – 6 Credits |
| 14:540:382 Comp Contr Mfg Sys | 3M | Spring and Summer |
| 14:540:383 Comp Contr Lab | 1M | |
| 14:180:215 Eng Graphics | 1 | |

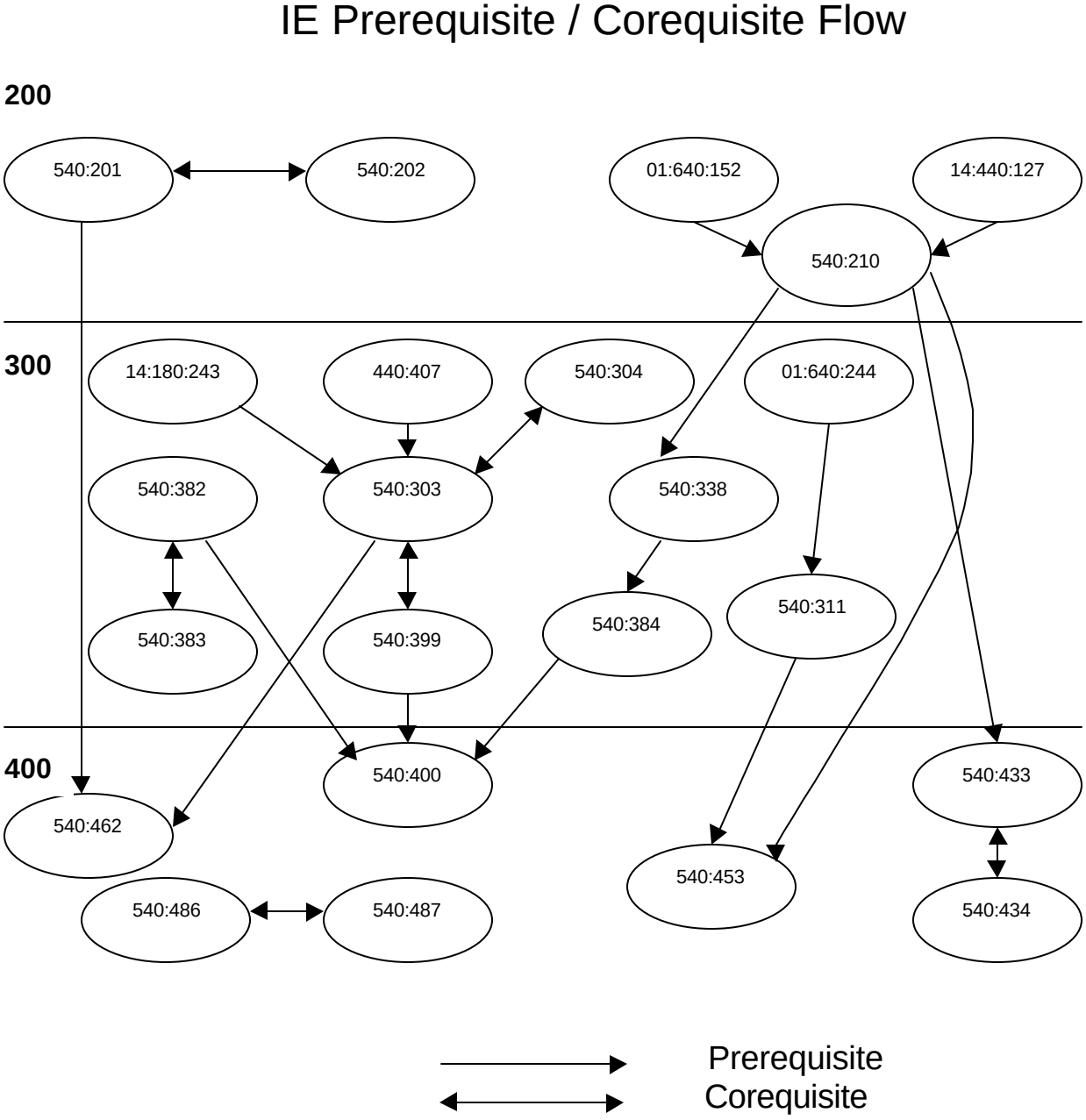
| **Fourth Year** | (16 cr. hrs.) | | (16 cr. hrs.) |
|---|---|---|---|
| 14:540:433 Quality Eng & Stat | 3M | 14:540:384 Simulat Models IE | 3M |
| 14:540:434 Quality Eng Lab | 1M | 14:540:311 Deter Models in OR | 3M |
| __:___:___ Dpt/Tech Elec (List A) | 3M | 14:540:303 Mfg Processes | 3M |
| __:___:___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

| **Fifth Year** | (15 cr. hrs.) |
|---|---|
| 14:540:453 Prod Plan & Control | 3M |
| 01:355:302 Sci & Tech Writing | 3 |
| 14:540:400 Design of Eng Syst II | 3M |
| 33:010:310 Account for Eng | 3M |
| __:___:___ Hum/Soc Elective | 3 |

**M – Course is included in major average.**
**Total credit hours: 138.**
**Major credit hours total: 62.**

**The Dept/Tech electives (List A & List B) for Class of 2000/2001/2002/2003 are given in Section 1.2 of this handbook.**

## 7. IE PREREQUISITE/COREQUISITE FLOW



## 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*
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*
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 01:640:144 AND 14:440:127 or 01:640:154 or 01:640:192 and 14:440:127 or 21:640:136 or 50:640:122 AND 14:440:127*
Probability problems in engineering, conditional probability, discrete and continuous distributions, functions or random variables, interval estimates.

**14:540:213 Industrial Engineering Laboratory (1M)**
Introduction to C programming, fundamental data types, flow control, and functions; arrays, pointers, and strings; algorithms and flow charts; application of dynamic memory allocation in simulation of queueing systems.

**14:540:242 Metal Processing (4M)**
*Lec. 3 hrs, lab. 3 hrs.*
Properties of engineering materials, casting, forming, and machining; basic machine tools processes, laser machining, waterjet cutting, micromachining, and tolerancing. Experimental work, microscopic analyses of metals, chip formation, and tool life.

**14:540:303 Manufacturing Processes (3M)**
*Corequisite: 14:540:304, Prerequisite: 14:440:407, 14:180:243*
Properties of materials, phase diagrams, metal forming and cutting. Basic and computerized machine tools. Process planning. Control charts.

**14:540:304 Manufacturing Process Laboratory (1M)**
*Corequisite: 14:540:303*
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**
*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*
Elements of problem solving and algorithmic design. Use of numerical analysis and linear algebra to solve industrial engineering problems. Linear programming, optimization techniques.

**14:540:338 Probability Models in Operations Research (3M)**
*Prerequisite: 14:540:210*
Decision making under uncertainty, Markov chains, inventory models, queueing systems.

**14:540:343 Engineering Economics (3M)**
*Open only to junior and senior engineering students.*
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 Computer Control of Manufacturing Systems (3M)**
*Corequisite: 14:540:383*
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 areas networks.

**14:540:383 Computer Control of Manufacturing Systems Laboratory (1M)**
*Corequisite: 14:540:382*
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: 14:540:210, 14:540:338*
Modeling and analysis of industrial and service systems, simulation modeling prospectives, discrete event and continuous simulation, simulation languages, statistical aspects of simulation.

**14:540:390 Manufacturing Processes and Materials for Engineers (3M)**
Properties of engineering materials, heat treating, welding, casting, forming, machining, and basic machine tool processes; experimental work, microscopic analysis of metals, ship formation, and tool life.

**14:540:399 Design of Engineering Systems I (3M)**
*Prerequisites or Corequisites: 14:540:303 and 14:540:304*
Design principles, material selection, design for assembly, design for manufacturing, effect of environmental issues on product design.

**14:540:400 Design of Engineering Systems II (3M)**
*Prerequisite: 14:540:303; 14:540:304; 14:540:384; 14:540:399, 14:540:382*
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.

**14:540:410 Linear Programming (3M)**
*Prerequisite: 14:540:311. Open only to seniors and graduate students in engineering.*
The methods and applications of linear programming, the Simplex method, the revised Simplex method, duality, transportation problems, postoptimality analysis, computer programs and solutions, decomposition and industrial application of linear programming.

**14:540:421 Industrial Organization and Management (3M)**
Nature and purpose of organizing, types or organizations, functions of management, human problems in industrial management. Organizational design, staffing, and human resource management.

**14:540:433 Quality Engineering and Statistics (3M)**
*Prerequisite: 14:540:210*
Statistical methods for controlling and improving product quality. Control charts, acceptance sampling, on- and off-line controls.

**14:540:434 Quality Engineering Laboratory (1M)**
*Corequisite: 14:540:433*
Practical application of quality engineering methodologies including on-line process control, design of experiments to improve product design, industrial manufacturing processes, and system design. Use of statistical quality control, software, data acquisition software, digital measurement instruments, and software and hardware interfaces.

**14:50:453 Production Planning and Control (3M)**
*Prerequisite: 14:540:311, 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)**
*Prerequisite: Permission of department. Open only to seniors and graduate students in engineering.*
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)**
*Prerequisites: 14:540:201, 303*
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.

**14:540:470, 471 Industrial Engineering Seminar (1M)**
The broad aspects of current engineering practices. Individual investigation and reports by students. Participation by representatives from industry.

**14:540:475 Introduction to Pharmaceutical Manufacturing (3M)**
Generic issues in pharmaceutical drug development and manufacturing processes such as regulatory issues including safety requirements (OSHA), the Good Manufacturing Practice (FDA) and others such as validation, quality control and automation. Sterile and non sterile manufacturing operations and packaging applications will be studied. Design and performance analysis of pharmaceutical production systems will be emphasized using analytical as well as simulation techniques. Case studies will be emphasized.

**14:540:484 Design of a Manufacturing Enterprise (3M)**
*Open only to senior industrial engineering majors.*
Senior-level capstone course. Students in small groups select product(s) to be manufactured, and design and justify the enterprise.

**14:540:485 Manufacturing Information Systems (3M)**
Design of information systems for integrated manufacturing. Modeling, specification, and implementation of factory information systems. Relational database model and structured query language. Methods of automatic data acquisition and integration of factory floor information with factory host database for production planning and control.

**14:540:486 Automated Manufacturing Systems (3M)**
*Corequisite: 14:540:487*
Introduction to computer-aided design and computer-aided manufacturing (CAD/CAM), numerical control, hardware and programming, robotics hardware and programming, and machine vision with applications in manufacturing.

**14:540:487 Automated Manufacturing Systems Laboratory (1M)**
*Corequisite: 14:540:486*
Use of CAD/CAM equipment to design and manufacture discrete parts. Experimentation with robotics with applications in manufacturing. Use of machine vision in manufacturing.

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

## CO-OP INTERNSHIP

## 540:496/497 CO-OP INTERNSHIP IN INDUSTRIAL AND SYSTEMS ENGINEERING (3,3 CREDITS, PASS/NO CREDIT BASIS ONLY)

## CATALOG DESCRIPTION:

The co-op internship provides the student with the opportunity to practice and/or apply knowledge and skills in various industrial and systems engineering environments. This co-op internship is intended to provide a practical engineering experience to the student' s undergraduate education by integrating prior course work into a working engineering environment. The credits earned are for the educational benefits of the experience.
***Prerequisite:*** 90 credits completed with a cumulative grade point average of at least 2.5

**Course Outline:** The students must satisfy the following criteria to be eligible for an internship:

The co-op internship must be with the same company for the summer and the fall semester.

**Note that the 6 credits are in addition to the 132 credit hours required for graduation. Students who choose the co-op internship option will complete their undergraduate degree requirements in the 9th semester.**

The following are the requirements to satisfy the undergraduate activities for credit:

1. A suitable project must be formulated as a self-contained individual effort under the supervision of a practicing professional and a faculty member.
2. A written proposal must be submitted to the Department by the student. The proposal must be approved by the Undergraduate Directors and the faculty advisor. The written proposal should include educational benefits, engineering related responsibilities at the work site, project tasks, and the plan for evaluation.
3. The registration is by special permission only, obtained from the Undergraduate Director.
4. Students hired as technicians within the Department cannot use this to fulfill the Co-op Internship requirement.
5. All internship work will be documented in a daily/weekly logbook, progress report, and a final report. The final report and the semester grade must be signed by the supervising practicing professional and the faculty member.
6. Students on co-op must be registered during the semesters that they are working.

# 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. Albin

## INSTITUTE OF INDUSTRIAL ENGINEERS (IIE)

The student chapter of IIE 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 include fall and Spring picnics, Freshman night, and a holiday mixer. By joining this society, each student receives a complimentary copy of Industrial Engineering with dues payment. Faculty Advisor: Dr. Coit

## 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, and scholarship opportunities. 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. Luxhoj

## 10. FACULTY

**Dr. Susan Albin** is Professor and Director of the Graduate Program in the Department of Industrial Engineering. Dr. Albin's research interests are in the area of quality engineering and stochastic modeling. She has worked on quality issues in industries including semiconductor manufacturing and electronics assembly, plastics recycling, medical devices and food processing. Dr. Albin's research has been supported by the NSF.FAA, the Foundation for Plastics Recycling, the Office of Army Research, and the Department of Defense. Dr. Albin teaches Quality Engineering and Stochastic Processes. Before joining Rutgers in 1981, she spent four years at Bell Laboratories and five years on the research staff at Albert Einstein College of Medicine. Dr. Albin received her DESc in Operations Research and Industrial Engineering from Columbia University in 1981; her MS and BS in Industrial Engineering from NYU. Dr. Albin has served as an Associate Editor for *Management Science* and is currently a Department Editor for the *IIE Transactions*. She was elected Council Member and then Secretary of INFORMS, the Institute for Operations Research and the Management Sciences. She is a member of IIE, and a senior member of ASQC. Dr. Albin is a recipient of an Exxon Education Foundation Award and is listed in *American Men and Women of Science* and *Who's Who in Science and Engineering*.

**Dr. Tayfur Altiok** is a Professor in the Department of Industrial Engineering. He received his Ph.D. from the Department of Industrial Engineering at North Carolina State University, Raleigh, NC in 1982. During 1992-1993, he was a visiting Professor at Laboratoire MASI, Universite de Pierre et Marie Curie, Paris, France. He was awarded a Fullbright Fellowship to lecture on performance modeling of manufacturing systems in Ankara, Turkey. He received several grants from NSF, NATO and The United Nations for research and teaching in design and modeling of manufacturing systems. His research interests include performance analysis and control of production systems, queueing systems, queueing networks, and simulation. He has published in numerous journals, co-edited books and has written a book on design of manufacturing systems. Since 1990, he has been involved in research for pharmaceutical manufacturing. He is a member of IIE and INFORMS.

**Dr. Thomas O. Boucher** is a Professor in the Department of Industrial Engineering. He received a BS in Electrical Engineering from the University of Rhode Island, an MBA from Northwestern University, and MS and Ph.D. degrees in Industrial Engineering from Columbia University and has previously taught at Cornell University. His teaching and research interests include engineering economics, manufacturing automation, and production planning and control. He is the Author *of Computer Automation in Manufacturing*, (Chapman-Hall,1996) and co-author of *Analysis and Control of Production Systems*, 2nd Ed., (Prentice-Hall, 1994). Dr. Boucher is an editorial board member *of The International Journal of Flexible Automation and Integrated Manufacturing* and the *Journal of Engineering, Valuation and Cost Analysis*. He is a member of IIE, SME, IEEE, Sigma Xi, and the New York Academy of Sciences.

**Dr. David Coit** is an Assistant Professor in the Department of Industrial Engineering. He received a BS in Mechanical Engineering from Cornell University, an MBA from Rensselaer Polytechnic Institute, and MS and Ph.D. degrees in Industrial Engineering from the University of Pittsburgh. His research interests are in the areas of reliability optimization, neural network modeling of manufacturing processes and evolutionary optimization. He previously worked for twelve years at IIT Research Institute, where he designed reliability programs for new product developments, developed reliability prediction models and analyzed failure data. He has had articles published in *IEEE Transactions on Reliability*, *INFORMS Journal on Computing*, *Computers and IE*, and *Computers and OR*. He is a member of IIE, INFORMS and IEEE.

**Dr. E. A. Elsayed** is a Professor and Chairman of the Department of Industrial Engineering. He is also Director of the NSF/Industry/University Cooperative Research Center for Quality and Reliability Engineering, Rutgers-Arizona State University. 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 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. Dr. Elsayed is also a co-author of *Analysis and Control of Production Systems*, Prentice-Hall, 2nd Edition, 1994. He is the author and co-author of work published in the *IIE Transactions, IEEE Transactions,* and the *International Journal of Production Research*. His research has been funded by the DoD, FAA, NSF, and industry. Dr. Elsayed has been a consultant for AT&T Bell Laboratories, Ingersoll-Rand, Johnson & Johnson, Personal Products, AT&T Communications, Ethicon, and other companies. Dr. Elsayed is the Editor-in-Chief of the *IIE Transactions* and the Editor of the *IIE Transactions on Quality and Reliability Engineering*. He is also an Editor for the *International Journal of Reliability, Quality and Safety Engineering*. He serves on the editorial boards of other journals such as the *International Journal of Production Research* and *Computers and Industrial Engineering*.

**Dr. Melike Gursoy** is an Associate Professor in the Department of Industrial Engineering. She received her BS and MS in Electrical Engineering from Bogozici University and her Ph.D. in Systems Engineering from the University of Pennsylvania. She teaches courses in optimization, stochastic processes, queuing theory, quality control, and inventory control. Her research interests are in the areas of stochastic modeling and control of telecommunication and production/inventory systems. She is a member of the IEEE Automatic Control Society and Communications Society, ORSA, and IIE.

**Dr. Mohsen A. Jafari** is an Associate Professor in the Department of Industrial Engineering. He received his MS.C. And Ph.D. in Industrial Engineering and Operations Research and another MS.C. In Computer Science from Syracuse University. Dr. Jafari's current teaching and research interests are in the areas of design and operational control of manufacturing systems, computer aided manufacturing, and simulation. He has taught previously at Syracuse University. He is a member of the IIE and IEEE.

**Dr. James T. Luxhoj** is an Associate Professor and Executive Officer in the Department of Industrial Engineering. He received his BS, MS, and Ph.D. in Industrial Engineering and Operations Research from Virginia Polytechnic Institute and State University. His teaching and research interests are in the areas of production economics, logistics and replacement and maintenance theory. Dr. Luxhoj was the recipient of a 1987 NASA/ASEE Summer Faculty Fellowship and was selected for 1989 SAE Ralph R. Teetor Award for Engineering Education Excellence. He is a member of the IIE. SOLE, Alpha Pi Mu, and Tau Beta Pi. Dr. Luxhoj was also the recipient of the 1991 Sigma Chi Outstanding Professor for Rutgers University. His teaching responsibilities have included Work Design & Productivity, Manufacturing Processes, Facilities Layout & Materials Handling, Production Analysis, and Advanced Engineering Economics I. He was a Visiting Professor in the Department of Production at Aalborg University during 1994-95.

**Dr. Hoang Pham** is an Associate Professor in the Department of Industrial Engineering. He received his MS in Statistics from the University of Illinois at Urbana-Champaign and MS and Ph.D. in Industrial Engineering from the State University of New York at Buffalo. Before joining Rutgers, Dr. Pham was a Senior Engineering Specialist with Idaho National Engineering Laboratory and The Boeing Company in Seattle. His research areas include reliability engineering, maintenance, software reliability, and fault-tolerant systems. Dr. Pham is the Editor-in-Chief of the *International Journal of Reliability, Quality and Safety Engineering*. He is finishing a book, *Software Reliability*, to be published by Springer-Verlag in December 1998. He is a senior member of IIE and IEEE..

**Dr. Shanxing Wang** is Assistant Professor in the Department of Industrial Engineering. He received his BE and ME from Xi'an Jiaotong University and his Ph.D. from the University of California, Berkeley, all in Mechanical Engineering. He joined the IE faculty in January 1999. He conducts research in the areas of micromachining, computational micromanufacturing, and manufacturing processes. His current research interest is focused on three-dimensional laser micromachining, which finds increasing applications in semiconductor, photonic, MEMS, and biomedical device manufacturing. He applies analytical modeling, computer simulation, and experimental techniques to study the relationships between process parameters and manufactured product quality for rapid process development. His teaching interests are manufacturing processes and design. He is an associate member of ASME and IEEE, and a member of SME, APS, and OSA.

## 11. FACULTY ADVISORS

| CLASS | ADVISOR | ROOM, EXT. |
|---|---|---|
| 2000 | Dr. Coit | Rm. 214, 5-2033 |
| 2001 | Dr. Gursoy | Rm. 218, 5-5465 |
| 2002 | Dr. Boucher | Rm. 224 5-3657 |
| 2003 | Dr. Luxhoj | Rm. 210, 5-3625 |
| Transfer &BS/BA | Dr. Boucher | Rm. 224, 5-3657 |

## 12. DEPARTMENTAL FACILITIES

**Manufacturing Automation Laboratory (CoRE 116)**: This laboratory is equipped with state-of-the-art equipment in CAD/CAM (Computer Aided Design and Computer Aided Manufacturing) and manufacturing automation equipment. It includes full scale CNC milling machines, CNC lathe, Puma, Mitsubishi and Seiko robots, an automated storage and retrieval system, a material handling carousel, a robot assembly work station, and a wide arrangement of CAD software including IDEAS and MASTERCAM. CAD stations and graphics terminals are also available.

**Manufacturing Processing Laboratory (CoRE 112)**: Basic machine tools such as turning, milling, drilling, grinding and measuring machines are available to help the student become familiar with metal-processing operations. The equipment is also used to perform laboratory experiments in heat treatment, chip formation, tool life, cutting forces, temperature, chip metallurgy and power consumption.

**Microcomputer Laboratory (CoRE 106)**: This lab is equipped with state-of-the-art microcomputers, minicomputers, printers and visual aids. The lab has a large number of simulation software such as SIMAN, XCELL, GPSS, PROMODEL, and optimization software LINDO, GINO,...etc. It has software for Quality Control, Plant Layout, Production Control, Statistical Analysis and text processing. The lab includes multimedia equipment such as a VCR, video cameras, and recording and editing software to enable students to make high quality multimedia presentations. This laboratory is connected to a university-wide network.

**Facilities Design and Productivity Laboratory (CoRE 110)**: This laboratory is used for instruction in the area of plant and facilities layout and design as well as in the area of materials handling and control. The lab is equipped with belt conveyors, plant layout prototypes and two and three-dimensional capabilities for facilities design. CAD stations for designing complex facilities are also available.

**Quality and Reliability Engineering Laboratory (CoRE 114)**: This lab is being 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 materials testing equipment, roundness measurement equipment, temperature chambers, vibration tests, and failure analysis equipment such as scanning electronic microscope (SEM) and voltage stressing equipment. LABVIEW and STATGRAPHICS software are available for student' s use.

**Manufacturing Information Systems Laboratory (WinLAB 101)**: This Laboratory is equipped with state-of-the-art programmable logic controllers and microcontrollers for controlling manufacturing processes, as well as binary and analog sensors for monitoring manufacturing processes, and bar code equipment and other automatic data acquisition devices used in manufacturing plants. State-of-the-art microcomputers with database management tools and data acquisition software are networked with programmable controllers to emulate supervisory control and data acquisition systems in a factory environment.

## 13. GENERAL INFORMATION

## IMPORTANT OFFICES:

**School of Engineering**

**Dean Michael Klein,** Dean, School of Engineering, Room B204, Engineering Building, 445-2214

**Dean Fred Bernath**, Associate Dean for Academic Affairs, Room B100, Engineering Building, 445-2212

**Dean Don Brown**, Assistant Dean for Special Programs, Room B110, Engineering Building, 445-2687

**Dean Jeffery Rankin**, Assistant Dean for First Year Students, Room B100, Engineering Building, 445-2212

**The Undergraduate Registrar -** Room 200F, Administrative Service Building, Davidson Road, Busch Campus, 445-3557

**Career Services -** 56 College Avenue, College Avenue Campus, 932-7997

**Financial Aid Room** - 140 Records Hall, College Avenue Campus, 932-7057

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

**International Student Center -** 180 College Avenue, College Avenue Campus, **Counselor to International Students** - 932-7015

**Student Accounting Records Hall**, College Avenue Campus, Room 138, 932-7581

**Undergraduate Course Periods**: Undergraduate courses mostly meet during the day. The time periods are as follows:

| **Period** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|---|
| Starts | 8:10 AM | 9:50 AM | 11:30 AM | 1:10 PM | 2:50 PM | 4:30 PM | 6:10 PM |
| Ends | 9:30 | 11:10 | 12:50 | 2:30 | 4:10 | 5:50 | 7:30 |

Class Periods - Start and End Times

## 14. ADDITIONAL INFORMATION

**Departmental Office**: The Industrial Engineering Department 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 8:30-4:30 PM, Monday through Friday. Closed for lunch between 12:00 - 1:00 PM.

**Electronic Mail**: All Rutgers students may obtain a computer account on the Eden machine in order to send and receive electronic mail. Go to the Micrographic Center in the basement of the Hill Center, Room 17, and the counselor there will show you how to create your account. The phone number is 445-2296 and they are open 10-6 PM Monday through Saturday.

**Employment Opportunities**: Job announcements are posted on the IE bulletin boards. Students are encouraged to make use of the Career Development and Placement Office on Busch campus.

**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.

**The Telephone Number** for the Department of Industrial Engineering is **(**732) 445-3654 and the fax number is (732) 445-5467. The area code and prefix is (732) 445 for all telephones - the extensions are given below.

| NAME | EXT | CORE | EMAIL |
|---|---|---|---|
| Albin, Susan | 2238 | 206 | salbin@rci.rutgers.edu |
| Altiok, Tayfur | 2829 | 208 | altiok@rci.rutgers.edu |
| Boucher, Thomas O. | **3**657 | 224 | tboucher@rci.rutgers.edu |
| Coit, David | 2033 | 214 | coit@rci.rutgers.edu |
| Elsayed, Elsayed A. | 3654 | 201 | elsayed@rci.rutgers.edu |
| Gursoy, Melike B. | 5465 | 218 | gursoy@rci.rutgers.edu |
| Jafari, Mohsen A. | 3627 | 220 | jafari@rci.rutgers.edu |
| Luxhoj, James T. | 3625 | 210 | jluxhoj@rci.rutgers.edu |
| Pham, Hoang | 5471 | 216 | hopham@rci.rutgers.edu |
| Wang, Shanxing | 5469 | 212 | shanxing@rci.rutgers.edu |
| Ielmini, Cindy | 3654 | 201 | ielmini@rci.rutgers.edu |
| Lippencott, Joseph | 5480 | 114 | lippen@rci.rutgers.edu |
| Smith-Perrilla, Helen | 3654 | 201 | helen@rci.rutgers.edu |
| Agrawal, Gaya | 5474 | 226 | |
| Lawrence, Sheila | 2829 | 208 | |
| Polaski, Thomas | 5474 | 226 | |
| Tilak, Avi | 5474 | 226 | |
| | | | |
| CAD/CAM Lab | 5480 | 116 | |
| Computer Control Lab | 3671 | 101(WINLAB/IE Bldg) | |
| MicroLab | 3671 | 106 | |
| Reliability Lab | 5480 | 114 | |
| Facility Design Lab | | 110 | |
| Manufacturing Processing Lab | 5480 | 112 | |
| Conference Room | | 203 | |

## 15. 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 6 PM.

**Access to First Floor IE Corridor**: The door is open weekdays from 9-12 and 1-4:30 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:**

- No food or beverages.
- Know the hazards of the material and equipment you are using.
- Use goggles in manufacturing laboratories.

Obtain permission of the lab director to use power.