

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 1 of 9

## COLLEGE OF ENGINEERING AND ENGINEERING TECHNOLOGY

### Department of Electrical Engineering

BOT Other Catalog Change Page 145, 2017-18 Graduate Catalog  
IBHE

### Department of Electrical Engineering

↓

#### Doctor of Philosophy in Electrical Engineering

A Ph.D. in Electrical Engineering allows graduates to pursue professional careers in institutions, national research labs, federal and state agencies, and private and public corporations. Students enrolled in the program will develop the ability to conduct independent research to address compelling problems of local, national, and global significance in Electrical Engineering application. Students will have a strong foundation in engineering knowledge, as subject matter experts within a traditional discipline of engineering, to pursue careers in engineering research, development, or education. Students will demonstrate the professional skills necessary to bridge the gap between the deep technical knowledge and scientific discoveries to practical application through careers in academe and industry. The overall goal of the program is to train and develop advanced practitioners, researchers, and teaching scholars in Electrical Engineering.

#### Learning Objective/Outcomes

Graduates of the Electrical Engineering Ph.D. program will demonstrate:

1. Fundamental understanding of the principles, major research findings and current unresolved problems in their area of emphasis
2. Effective scientific communication skills
3. Proficiency in critical thinking,
4. Appropriate use of the scientific method.
5. Technical writing proficiency
6. Original scholarship and the ability to conduct independent research.

#### Admission Requirements

Students seeking admission to the Ph.D. program in Electrical Engineering must have a B.S. degree. Students with backgrounds in fields other than Electrical Engineering are encouraged to apply, but are required to take core Electrical Engineering courses as part of the doctoral program. In addition to ~~The~~ the Graduate School minimum requirements, applicants must also have a minimum GPA of 3.00/4.00 and submit three letters of recommendation.

#### Course Requirements

The Graduate Studies Committee, in consultation with the faculty ~~advisor~~ ~~advisor~~ and the chair of the department, is responsible for approving each student's program to meet the course requirements specified below. Each student must complete at least 90 semester hours of graduate course work after the baccalaureate degree. Students with a master's degree can transfer up to 30 semester hours of graduate course work. The committee will assess all work done at other institutions and will recommend acceptance of transfer credit for any graduate work deemed appropriate, subject to the policies of and approval by the Graduate School. In

**Received by the Graduate Council April 2, 2018**

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

**SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog** p. 2 of 9

In addition to meeting all of the course requirements below, students must ensure at least 1/2 of their course work is at the 600-level or above, with the exception of dissertation hours.

The Graduate Studies Committee of the department is also responsible for the administration of the candidacy examination. In addition, all students are required to complete the following.

**Core Courses (12)**

All students are required to take 12 semester hours in Electrical Engineering in one of the focus areas listed below:

**Digital Signal Processing and Communication (12)**

- ELE 525 - Biomedical Signal Processing (3)
- ELE 551 - Digital Filter Design (3)
- ELE 552 - Real-Time Digital Signal Processing (3)
- ELE 650 - Digital Signal Processing (3)
- ELE 651 - Random Signal Processing (3)
- ELE 653 - ~~Digital~~ Speech ~~Signal~~ Processing (3)
- ELE 654 - Advanced Topics in Digital Image Processing (3)
- ELE 659 - Adaptive Signal Processing (3)
- ELE 660 - Digital and Analog Communication Systems (3)
- ELE 661 - Error Control Coding (3)
- ELE 662 - Optical Communication (3)
- ELE 664 - Spread Spectrum Communication Systems (3)
- ELE 665 - Satellite Communications (3)

**Computer Engineering, Power Electronics and Control (12)**

- ELE 530 - Design with Field Programmable Logic Devices (3)
- ELE 540 - Power Electronics (3)
- ELE 557 - ~~Processor~~-based Systems (3)
- ~~ELE 581 - Digital Control Systems (3)~~
- ~~ELE 640 - Advanced Power Electronics~~
- ELE 655 - Microprocessor System Design (3)
- ELE 657 - Parallel Processing (3)
- ~~ELE 581 - Digital Control Systems (3)~~
- ~~ELE 640 - Advanced Power Electronics~~
- ELE 683 - Computerized Control and Modeling of Automated Systems (3)
- ELE 685 - Control Laws and Strategies for Multilink Manipulators (3)
- ELE 687 - Fuzzy Logic in Engineering (3)
- ELE 689 - Introduction to Neural Networks (3)

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 3 of 9

### **Semiconductor Fabrication, MEMs and Devices (12)**

ELE 521 - Biomedical Sensor Engineering (3)

ELE 532 - Semiconductor Device Fabrication Laboratory (3)

ELE 535 - Integrated Circuit Engineering (3)

~~ELE 532 - Semiconductor Device Fabrication Laboratory (3)~~

ELE 537 - Hybrid Circuit Design (3)

ELE 538 - Thin Film Engineering (3)

ELE 630 - Advanced Integrated Circuit Engineering (3)

ELE 631 - VLSI Engineering: Computer-Aided Design (3)

ELE 632 - VLSI Engineering: Device Design (3)

ELE 633 - VLSI Engineering: Chip Design (3)

ELE 634 - Integrated Circuit Design for Testability (3)

ELE 635 - Advanced Electronic Devices (3)

ELE 636 - Design of Microsystems (3)

ELE 637 - Thin Film Resistive Sensors (3)

### **Radio Frequency and Antenna Design (12)**

ELE 537 - Hybrid Circuit Design (3)

ELE 561 - Synthesis of Active and Passive Filters (3)

ELE 574 - Transmission Line Media and Wave Propagation (3)

ELE 575 - Antenna Theory and Design (3)

ELE 635 - Advanced Electronic Devices (3)

ELE 660 - Digital and Analog Communication Systems (3)

ELE 670 - Microwave Circuits and Devices (3)

ELE 672 - Microwave Solid-State Devices and Circuits (3)

ELE 673 - Time Harmonics Electromagnetic Fields (3)

ELE 674 - Microwave Measurement and Beam Instrumentation Laboratory (3)

ELE 677 - Advanced Microwave and Millimeter Wave Engineering (3)

~~ELE 635 - Advanced Electronic Devices (3)~~

~~ELE 660 - Digital and Analog Communication Systems (3)~~

~~ELE 672 - Microwave Solid-State Devices and Circuits (3)~~

### **Doctoral Seminar (3)**

Students are required to register for three semesters of ELE 791, Doctoral Seminar.

### **Technical Writing (3)**

All students must take ENGL 626, Technical Writing.

### **Elective Course Work (45)**

An additional 45 semester hours of graduate course work as electives. Elective courses can be graduate courses in Electrical Engineering and related disciplines outside the department. All elective courses must be approved by the Graduate Studies Committee, in consultation with the faculty ~~advisor~~ advisor and the chair of the

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 4 of 9

department. Students in the professional track need to take 3 ~~credit-semester~~ hours of Industry Residency (ELE 701).

#### **Dissertation (27)**

A minimum of 27 semester hours in ELE 799, Doctoral Research and Dissertation.

#### **Candidacy Examination**

The candidacy exam is a written examination based on the core courses. The examination is to be taken within one year after completion of the core courses. A student who fails the candidacy examination may be granted the opportunity to retake it. Failure on the second attempt denies the student admission to candidacy.

#### **Dissertation Committee**

The dissertation committee for each student will be nominated by the chair of the department and appointed by the dean of the Graduate School. This committee will consist of three to five graduate faculty members and will otherwise meet the specifications of the Graduate School. It will be chaired by the faculty ~~advisor~~ adviser, who is appointed by the chair of the department and the dean of the College of Engineering and Engineering Technology and the dean of the Graduate School.

#### **Dissertation Proposal Examination**

An oral examination of a proposal of a dissertation topic is required after the student has completed at least 45 semester hours of courses. This examination will be evaluated by the dissertation committee and must be found satisfactory before the candidate may continue his or her progress towards completion of the doctoral degree requirements. A student who fails the examination may be granted the opportunity to retake it. Failure on the second attempt will terminate the student from the Ph.D. program in Electrical Engineering.

#### **Oral Dissertation Defense**

An oral examination on the dissertation will be conducted by the dissertation committee according to the Graduate School regulations.

### **Department of Industrial and Systems Engineering**

BOT  
IBHE

Other Catalog Change

Page 150, 2017-18 Graduate Catalog

#### **Doctor of Philosophy in Industrial and Systems Engineering**

A Ph.D. in Industrial and Systems Engineering (ISYE) allows graduates to pursue professional careers at academic institutions, national research labs, federal and state agencies, and private and public corporations. Students enrolled in the program will develop the ability to identify and pursue important research questions pertaining to the field of Industrial and Systems Engineering. Students will also acquire the quantitative, qualitative, and methodological research skills needed to advance research findings that contribute to the development of the economy, society, and industry, either locally or globally. Training focuses on the engineering process, skills, and critical thinking necessary to design and execute scientific and engineering research. Training through research and study of the primary literature endows graduates of the program with enhanced content knowledge, applied skills and a fundamental understanding of the engineering process and

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 5 of 9

technology to prescribe scientific solutions. The overall goal of the program is to train and develop advanced practitioners, researchers and teaching scholars in Industrial and Systems Engineering.

**Learning Objective/Outcomes**

Graduates of the Ph.D. program in Industrial and Systems Engineering will be able to demonstrate the following objectives/outcomes:

- a) Advanced Knowledge. Master advanced concepts, methods and technologies in industrial and systems engineering thrust areas.
- b) Methods. Understand and apply research methodologies to relevant industrial and systems engineering questions, issues, and problems.
- c) Research. Conduct independent research that results in an original contribution to knowledge that meets all the standards for responsible conduct of research.
- d) Ethics. Demonstrate knowledge and understanding of ethical standards in executing research.
- e) Communication. Communicate research to both technical and general audiences in an effective manner through oral and written formats.

**Admission Requirements**

Students seeking admission to the Ph.D. program in Industrial and Systems Engineering must have a B.S. degree. In addition to ~~The~~ the Graduate School minimum requirements, applicants must also have a minimum GPA of 3.00/4.00 and submit three letters of recommendation.

**Course Requirements**

The Graduate Studies Committee, in consultation with the faculty ~~advisor~~ ~~adviser~~ and the chair of the department, is responsible for approving each student's program to meet the course requirements specified below. Each student must complete at least 90 semester hours of graduate course work after the baccalaureate degree. Students with a master's degree can transfer up to 30 semester hours of graduate course work. The committee will assess all work done at other institutions and will recommend acceptance of transfer ~~semester credit~~ for any graduate work deemed appropriate, subject to the policies of and approval by the Graduate School. In addition to meeting all of the course requirements below, students must ensure at least ~~1/2~~ half of their course work is at the 600-level or above, excluding dissertation hours.

The Graduate Studies Committee of the department is also responsible for the administration of the candidacy examination. In addition, all students are required to complete the following.

**Core Courses (12)**

All Ph.D. students must successfully complete:

- ISYE 671 - Linear Programming and Network Flows ~~Credits: 3~~(3)

Students must complete at least three from the following list:

ISYE 510 - Human Factors Engineering (3)~~Credits:3~~

OR ISYE 691 - Occupational Ergonomics (3)~~Credits:3~~

ISYE 530 - Quality Control (3)~~Credits:3~~

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 6 of 9

- OR ISYE 630 - Advanced Quality Control (3)Credits:3
- ISYE 540 - Production Planning and Control (3)Credits:3
- OR ISYE 640 - Advanced Production and Inventory Control (3)Credits:3
- ISYE 570 - Introduction to Data Analytics for Engineers (3)Credits:3
- OR ISYE 670 - Data Analytics for Engineers (3)Credits:3
- ISYE 580 - Simulation Modeling and Analysis (3)Credits:3
- OR ISYE 680 - Advanced Simulation Techniques (3)Credits:3

**Seminar (3)**

Students are required to register for three semesters of ISYE 795, Doctoral Seminar.

**Technical Writing (3)**

All students must take ENGL 626, Technical Writing.

**Industry Residency (3)**

All students must take ISYE 701, Industry Residency after successfully completing the candidacy examination.

**Electives (48)**

An additional 48 semester hours of graduate course work as electives. Elective courses can be graduate courses in Industrial and Systems Engineering and related disciplines outside the department. All elective courses must be approved by the Graduate Studies Committee, in consultation with the faculty advisor and the chair of the department.

**Dissertation (21)**

A minimum of 21 semester hours of ISYE 799, Doctoral Dissertation must be taken. The student must successfully pass the candidacy examination before taking ISYE 799.

**Candidacy Examination**

The candidacy exam is a written examination based on the core courses. The examination is to be taken within one year after completion of the core courses. The exam will cover linear programming, statistics, ergonomics, quality, production planning and simulation. A student who fails the candidacy examination may be granted the opportunity to retake it. Failure on the second attempt denies the student admission to candidacy.

**Dissertation Committee**

The dissertation committee for each student will be nominated by the chair of the department and appointed by the dean of the Graduate School. This committee will consist of three to five graduate faculty members and will otherwise meet the specifications of the Graduate School. It will be chaired by the faculty advisor, who is appointed by the chair of the department and the dean of the College of Engineering and Engineering Technology and the dean of the Graduate School.

**Dissertation Proposal Examination**

An oral examination of a proposal of a dissertation topic is required after the student has completed at least 45

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 7 of 9

semester hours of courses. This examination will be evaluated by the dissertation committee and must be found satisfactory before the candidate may continue his or her progress towards completion of the doctoral degree requirements. A student who fails the examination may be granted the opportunity to retake it. Failure on the second attempt will terminate the student from the Ph.D. program in Industrial and Systems Engineering.

#### **Oral Dissertation Defense**

An oral examination on the dissertation will be conducted by the dissertation committee according to the Graduate School regulations.

### **Department of Mechanical Engineering**

BOT  
IBHE

Other Catalog Change

Page 155, 2017-18 Graduate Catalog

#### **Doctor of Philosophy in Mechanical Engineering**

The Department of Mechanical Engineering offers a program leading to the Ph.D. in mechanical engineering. A Ph.D. allows graduates to pursue professional careers at academic institutions, national research labs, federal and state agencies, and industry. Students enrolled in the program will develop the ability to identify and pursue important research questions pertaining to the field of mechanical engineering. Training focuses on the engineering process and critical thinking necessary to design and execute scientific and engineering research.

#### **Learning Objectives/Outcomes**

Graduates of the Ph.D. program in Mechanical Engineering will be able to demonstrate the following outcomes:

- a) *Advanced knowledge.* Master advanced concepts, methods and technologies in a core mechanical engineering thrust area.
- b) *Analysis.* Apply in depth qualitative analysis to relevant mechanical engineering questions, issues, and problems.
- c) *Research.* Conduct independent research that results in an original contribution to knowledge that meets all the standards for responsible conduct of research.
- d) *Ethics.* Demonstrate knowledge and understanding of ethical standards in executing research.
- e) *Communication.* Communicate research to both technical and general audiences in an effective manner through oral and written formats.

#### **Admission Requirement**

Students seeking admission to the Ph.D. program in Mechanical Engineering must meet all requirements for admission to the Graduate School and shall have satisfied the requirements (or equivalent) for the B.S. in Mechanical Engineering at NIU. Students with backgrounds in fields other than mechanical engineering are encouraged to apply, but may be required to take a sequence of core mechanical engineering courses as part of the doctoral program. Students seeking admission who possess a master's degree will also be expected to have met the above requirements. In addition, the department asks for a personal statement along with three letters of recommendation. Admission to the Ph.D. program is not automatic for students completing their M.S. degree in the department. Master's students who desire to continue on to the Ph.D. must apply for admission. Nondegree

Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 8 of 9

applicants may be admitted for no more than 8 semester hours.

**Course Requirements**

The Graduate Studies Committee, in consultation with the faculty ~~advisor~~ ~~adviser~~ and the chair of the department, is responsible for approving each student's program to meet the course requirements specified below. Each student must complete at least 90 semester hours of graduate course work after the baccalaureate degree. Students with a master's degree may be able to transfer up to 30 semester hours of graduate course work at the discretion of the Graduate Studies Committee. The Graduate Studies Committee, in consultation with the faculty ~~advisor~~ ~~adviser~~ and the chair of the department, will assess all work completed at other institutions and will recommend acceptance of transfer credit for graduate work deemed appropriate, subject to the policies of an approval by the Graduate School. Two-thirds of a student's coursework must be at the 600-level or above, with the exception of dissertation hours.

**Core Courses (21)**

All students are required to take 21 semester hours in mechanical engineering at or above the 600-level, excluding MEE 697, MEE 698, MEE 699, MEE 701, MEE 795, and MEE 799. It is recommended that students choose a focus area related to their research, but taking any combination of ~~upper~~ ~~upper~~-level mechanical engineering courses, not explicitly excluded above, will qualify towards this requirement.

**Distribution Requirement (15)**

All students are required to take at least 15 semester hours of additional graduate course work pertaining to their research and field of study, excluding MEE 697, MEE 698, MEE 699, MEE 701, MEE 795, and MEE 799. At least three ~~semester~~ ~~credit~~ hours must be outside of the College of Engineering ~~& and Engineering~~ Technology. At least three ~~semester~~ ~~credit~~ hours must be at the 600-level or above.

**Department Seminar (3)**

Students are required to register for and attend the department seminar, MEE 795, for three semesters total.

**Dissertation (27)**

Students must take a minimum of 27 semester hours in MEE 799, Doctoral Research and Dissertation.

**Elective Course Work (24)**

Students must take an additional 24 ~~semester~~ ~~credit~~ hours of graduate course work. This may include additional hours of dissertation, MEE 799, beyond the ~~27-27-semester~~ ~~hour~~ ~~credit~~ requirement, and it may include MEE 701, Industry Residency. The courses chosen to meet this requirement are subject to the approval of the Graduate Studies Committee, in consultation with the faculty ~~advisor~~ ~~adviser~~ and the chair of the department.

**Candidacy Exam**

The candidacy exam is an oral examination based on core courses that the student takes. The examination is to



Received by the Graduate Council April 2, 2018

GRADUATE COUNCIL CURRICULUM COMMITTEE (GCCC)  
Second Meeting/2017-18 Academic Year  
November 13, 2017

SECTION B – Recorded, but further approval needed before inclusion in the Graduate Catalog p. 9 of 9

be taken within one year after completion of the core courses.

#### **Dissertation Committee**

The dissertation committee for each student will be nominated by the chair of the department and appointed by the dean of the Graduate School. This committee will consist of three to five graduate faculty members and will be chaired by the dissertation advisor who has been appointed by the chair of the department.

#### **Dissertation Proposal Examination**

An oral examination of a proposal of a dissertation topic is required after the student has completed at least 45 ~~credit-semester~~ hours of courses toward the Ph.D. The examination will be evaluated by the dissertation committee and must be found satisfactory before the candidate may continue his or her progress towards completion of the doctoral degree requirements.

#### **Oral Dissertation Defense**

An oral examination on the dissertation will be conducted by the dissertation committee according to Graduate School regulations.

#### **Professional Track**

There is an opportunity for those wanting to work in industry after obtaining a Ph.D. Students in the professional track work on research projects of interest to an industrial collaborator. Such students are required to take at least three ~~credit-semester~~ hours of MEE 701, Industry Residency, as elective course work. Other elective courses may focus on business, finance, or other subjects relevant to the professional goals of the student, subject to approval by the ~~advisor~~ ~~advisor~~ and Graduate Studies Committee.