# ELECTRICAL ENGINEERING DEGREE

Students must also complete the Undergraduate Registration Requirement (https://catalogs.northwestern.edu/undergraduate/requirements-policies/undergraduate-registration-requirement/) and the degree requirements of their home school.

## Requirements (48 units total)

| Course | Title |
|---|---|
| **Core Courses (32 units)** [1] | |
| 4 mathematics courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) | |
| 4 engineering analysis and computer proficiency courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) | |
| 4 units of basic science: [2] | |
| PHYSICS 135-2 & PHYSICS 136-2 | General Physics and General Physics Laboratory |
| PHYSICS 135-3 & PHYSICS 136-3 | General Physics and General Physics Laboratory |
| 1.33 units chosen from McCormick-approved basic science courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) | |
| Maximum of 3 basic science units may come from any one area | |
| 5 basic engineering courses: | |
| ELEC_ENG 202-0 | Introduction to Electrical Engineering |
| COMP_ENG 203-0 | Introduction to Computer Engineering |
| ELEC_ENG 302-0 | Probabilistic Systems |
| COMP_SCI 211-0 | Fundamentals of Computer Programming II |
| or COMP_SCI 230-0 | Programming for Engineers |
| 1 course from one of the following basic engineering categories: fluids and solids, materials science and engineering, systems engineering and analysis, thermodynamics | |
| 3 design and communications courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) | |
| 7 social sciences/humanities courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) | |
| 5 unrestricted electives (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) | |

1 See general requirements (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) for details.

2 PHYSICS 125-2 General Physics for ISP or PHYSICS 140-3 Fundamentals of Physics may be substituted for PHYSICS 135-2 General Physics. PHYSICS 125-3 General Physics for ISP or PHYSICS 140-3 Fundamentals of Physics may be substituted for PHYSICS 135-3 General Physics. Associated labs are PHYSICS 126-2 Physics for ISP Laboratory or PHYSICS 136-2 General Physics Laboratory and PHYSICS 126-3 Physics for ISP Laboratory or PHYSICS 136-3 General Physics Laboratory.

| Course | Title |
|---|---|
| **Major Program (16 units)** | |
| 5 required courses: | |
| ELEC_ENG 221-0 | Fundamentals of Circuits |
| ELEC_ENG 222-0 | Fundamentals of Signals & Systems |
| ELEC_ENG 223-0 | Fundamentals of Solid State Engineering |
| ELEC_ENG 224-0 | Fund of Electromagnetics & Photonics |
| ELEC_ENG 225-0 | Fundamentals of Electronics |
| 10 technical electives: [2] | |
| *At least 6 courses from the following tracks:* | |
| Biomedical engineering track (p. 1) | |
| Circuits and electronics track (p. 1) | |
| Communications systems track (p. 2) | |
| Control systems track (p. 2) | |
| Signal processing and machine learning track (p. 2) | |
| Electromagnetics and optics track (p. 2) | |
| Solid-state engineering track (p. 2) | |
| *2 courses from 300-level or 400-level COMP_SCI, ELEC_ENG, or COMP_ENG technical electives (which may include COMP_ENG 205-0 and the courses above)* | |
| *2 courses may be chosen from:* | |
| 300-level technical courses in science, mathematics, computer science, or engineering or the courses above | |
| BIOL_SCI 201-0 | Molecular Biology |
| BIOL_SCI 202-0 | Cell Biology |
| BIOL_SCI 203-0 | Genetics and Evolution |
| CHEM 215-1 & CHEM 215-2 & CHEM 215-3 | Organic Chemistry I and Organic Chemistry II and Advanced Organic Chemistry |
| 1 required design course from: | |
| ELEC_ENG 327-0 | Electronic System Design II: Project |
| COMP_ENG 347-1 | Microprocessor Systems Project I |
| COMP_ENG 392-0 | VLSI Systems Design Projects |
| ELEC_ENG 398-0 | Electrical Engineering Design |
| ELEC_ENG 399-0 | Projects |

1 See general requirements (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) for details.

2 No more than 2 units of ELEC_ENG 399-0 Projects will be counted as technical electives. Additional units of ELEC_ENG 399-0 Projects may be taken but will be counted as unrestricted electives.

3 When ELEC_ENG 399-0 Projects is a design project and the student has senior standing

## Technical Elective Tracks

### Biomedical Engineering Track

| Course | Title |
|---|---|
| BMD_ENG 325-0 | Introduction to Medical Imaging |
| BMD_ENG 327-0 | Magnetic Resonance Imaging |
| BMD_ENG 333-0 | Modern Optical Microscopy & Imaging |

### Circuits and Electronics Track

| Course | Title |
|---|---|
| COMP_ENG 303-0 | Advanced Digital Design |
| COMP_ENG 346-0 | Microprocessor System Design |
| COMP_ENG 347-2 | Microprocessor Systems Project II |
| COMP_ENG 355-0 | ASIC and FPGA Design |
| COMP_ENG 391-0 | CMOS VLSI Circuit Design |
| COMP_ENG 393-0 | Advanced Low Power VLSI and Mixed-signal IC Design |
| ELEC_ENG 326-0 | Electronic System Design I |

| | |
|---|---|
| ELEC_ENG 327-0 | Electronic System Design II: Project |
| ELEC_ENG 353-0 | Digital Microelectronics |

## Communications Systems Track

| Course | Title |
|---|---|
| ELEC_ENG 307-0 | Communications Systems |
| ELEC_ENG 328-0 | Information Theory & Learning |
| ELEC_ENG 333-0 | Introduction to Communication Networks |
| ELEC_ENG 334-0 | Fundamentals of Blockchains and Decentralization |
| ELEC_ENG 378-0 | Digital Communications |
| ELEC_ENG 380-0 | Wireless Communications |

## Control Systems Track

| Course | Title |
|---|---|
| ELEC_ENG 360-0 | Introduction to Feedback Systems |
| ELEC_ENG 374-0 | Introduction to Digital Control |
| ELEC_ENG 390-0 | Introduction to Robotics |
| MECH_ENG 333-0 | Introduction to Mechatronics |

## Signal Processing and Machine Learning Track

| Course | Title |
|---|---|
| ELEC_ENG 332-0 | Introduction to Computer Vision |
| ELEC_ENG 335-0 | Deep Learning Foundations from Scratch |
| ELEC_ENG 359-0 | Digital Signal Processing |
| ELEC_ENG 363-0 | Digital Filtering |
| ELEC_ENG 373-0 | Deep Reinforcement Learning |
| ELEC_ENG 375-0 | Machine Learning: Foundations, Applications, and Algorithms |

## Electromagnetics Engineering Track

| Course | Title |
|---|---|
| ELEC_ENG 308-0 | Applied Electromagnetics and Photonics |
| ELEC_ENG 379-0 | Lasers and Coherent Optics |
| ELEC_ENG 382-0 | Photonic Information Processing |
| ELEC_ENG 383-0 | Fiber-Optic Communications |

## Solid-State Engineering Track

| Course | Title |
|---|---|
| ELEC_ENG 250-0 | Physical Electronics and Devices |
| ELEC_ENG 381-0 | Electronic Properties of Materials |
| ELEC_ENG 384-0 | Solid State Electronic Devices |
| ELEC_ENG 385-0 | Optoelectronics |
| ELEC_ENG 388-0 | Nanotechnology |
| MECH_ENG 381-0 | Introduction to Micro-electro-mechanical Systems |