

# ELECTRICAL ENGINEERING, B.S.

At Saint Louis University's School of Science and Engineering, we have developed a unique, hands-on electrical engineering program that incorporates analysis, design and development of electrical systems.

As a student in the electrical engineering program at SLU, you will gain a solid foundation through a combination of coursework and hands-on learning. You will use the physical properties of electricity and mathematics to design systems that collect, analyze and use information as well as distribute and utilize electrical energy and design the electrical systems that are at the heart of today's technology such as smartphones, tablets, internet-ready televisions, satellites and many other devices.

With easy access to a sophisticated design laboratory and other technological spaces, graduates will have the necessary skills for entry into the profession as productive and effective engineers or to pursue graduate education.

A Bachelor of Science (B.S.) in Electrical Engineering can also be obtained with the following options:

- Bachelor of Science (B.S.) in Electrical Engineering, emphasis in bioelectronics (pre-health)
- Bachelor of Science (B.S.) in Electrical Engineering, emphasis in bioelectronics (engineering emphasis)

The bioelectronics concentration is a joint effort between the electrical engineering and biomedical engineering programs. The course of study combines science and engineering, incorporating courses in biology, chemistry, math, biomedical engineering, electrical and electronic engineering and others.

## Curriculum Overview

SLU's electrical engineering program coursework provides students with both breadth and depth in electrical engineering. The program develops in students the ability to apply knowledge of mathematics, sciences and electrical engineering to find solutions to practical problems. It ensures that graduates have an opportunity to work on multidisciplinary teams and develop effective communication skills.

In addition to a strong focus on core areas of electrical engineering, the program provides a design experience that is integrated throughout the program by introducing fundamental elements of the design process throughout student coursework. The program also includes a two-semester design sequence to provide a meaningful and significant engineering design experience that focuses on and prepares students for professional practice.

## Fieldwork and Research Opportunities

SLU's B.S. degree in electrical engineering is designed to give students the tools they need to excel regardless of the industry in which they choose to work.

Electrical engineering students benefit from many internship and career opportunities. Students are encouraged and assisted in obtaining summer internships in local, national and international companies through SLU's Career Services. Undergraduate students

have opportunities to conduct research with School of Science and Engineering College faculty during the summer, fall and spring semesters.

The program supports many club activities that involve electrical engineering practice as part of their activities. These include IEEE, autonomous mobile robotics, cube satellite design, AUVSI autonomous flight and others. These extracurricular activities enhance the lessons learned in the classroom and help students gain invaluable experience that will prepare them for their careers after graduation.

## Careers

Students who graduate from the program with the bioelectronics concentration in electrical engineering will find a wealth of career opportunities in the bioengineering industry. Examples are hospital clinical engineering, medical device manufacturing/vendors, healthcare research and design centers and medical/university laboratories.

Students pursuing the pre-health emphasis are well prepared to enter a highly challenging and rewarding field of medicine. Bioelectronics with the pre-health emphasis provides an excellent opportunity for future medical doctors to be well versed in technological advances. It allows for much greater integration and innovation of technology in medicine, for example, the uses of MRI and CT scans.

Our graduates have found employment at companies and government agencies such as:

- Ameren
- Boeing
- Emerson Electric
- Intel
- Rockwell
- Space-X
- Tellabs
- Texas Instruments
- U.S. Air Force

## Admission Requirements

### Begin Your Application (<http://www.slu.edu/apply.php>)

Saint Louis University also accepts the Common Application.

### Freshman

All applications are thoroughly reviewed with the highest degree of individual care and consideration to all credentials that are submitted. Solid academic performance in college preparatory coursework is a primary concern in reviewing a freshman applicant's file.

To be considered for admission to any Saint Louis University undergraduate program, applicants must be graduating from an accredited high school, have an acceptable HiSET exam score or take the General Education Development (GED) test.

### Transfer

Applicants must be a graduate of an accredited high school or have an acceptable score on the GED.

Students who have attempted fewer than 24 semester credits (or 30 quarter credits) of college credit must follow the above freshmen admission requirements. Students who have completed 24 or more

semester credits (or 30 quarter credits) of college credit must submit transcripts from all previously attended college(s).

In reviewing a transfer applicant's file, the Office of Admission holistically examines the student's academic performance in college-level coursework as an indicator of the student's ability to meet the academic rigors of Saint Louis University. Where applicable, transfer students will be evaluated on any courses outlined in the continuation standards of their preferred major.

## International Applicants

All admission policies and requirements for domestic students apply to international students along with the following:

- Demonstrate English Language Proficiency (<https://catalog.slu.edu/academic-policies/office-admission/undergraduate/english-language-proficiency/>)
- Proof of financial support must include:
  - A letter of financial support from the person(s) or sponsoring agency funding the time at Saint Louis University
  - A letter from the sponsor's bank verifying that the funds are available and will be so for the duration of study at the University
- Academic records, in English translation, of students who have undertaken postsecondary studies outside the United States must include the courses taken and/or lectures attended, practical laboratory work, the maximum and minimum grades attainable, the grades earned or the results of all end-of-term examinations, and any honors or degrees received. WES and ECE transcripts are accepted.

## Additional Admission Requirements

In addition to the general admission and matriculation requirements of the University, applicants to SLU's engineering programs must meet the following requirements:

- **GPA:** Minimum cumulative 3.00 high school GPA for freshmen applicants and 2.70 college GPA for transfer applicants.
- **Coursework:** Fifteen total units of high school work are required: three or four units of English; four or more units of mathematics, including algebra I and II, geometry and precalculus (Algebra II with Trigonometry is not sufficient). Students should be prepared to start the first semester of freshmen year in Calculus I or higher; three or four units of science, including general science, introduction to physical science, earth science, biology, physics or chemistry; two or three units of social sciences including history, psychology or sociology; and three units of electives.

Admission to the School of Science and Engineering's degree programs is based on a combination of secondary school grades, college admission test scores, co-curricular activities and attempted college coursework, as well as other indicators of the applicant's ability, career focus and character. This process respects the non-discrimination policy of the University and is designed to select a qualified, competent and diverse student body with high standards of scholarship and character, consistent with the mission of the University.

## Tuition

Tuition	Cost Per Year
Undergraduate Tuition	\$52,260

Additional charges may apply. Other resources are listed below:

Net Price Calculator (<https://www.slu.edu/financial-aid/tuition-and-costs/calculator.php>)

Information on Tuition and Fees (<https://catalog.slu.edu/academic-policies/student-financial-services/tuition/>)

Miscellaneous Fees (<https://catalog.slu.edu/academic-policies/student-financial-services/fees/>)

Information on Summer Tuition (<https://catalog.slu.edu/academic-policies/student-financial-services/tuition-summer/>)

## Scholarships and Financial Aid

There are two principal ways to help finance a Saint Louis University education:

- **Scholarships:** Scholarships are awarded based on academic achievement, service, leadership and financial need.
- **Financial Aid:** Financial aid is provided through grants and loans, some of which require repayment.

Saint Louis University makes every effort to keep our education affordable. In fiscal year 2022, 99% of first-time freshmen and 90% of all students received financial aid (<https://www.slu.edu/financial-aid/>) and students received more than \$445 million in aid University-wide.

For priority consideration for merit-based scholarships, apply for admission by December 1 and complete a Free Application for Federal Student Aid (FAFSA) by March 1.

For information on other scholarships and financial aid, visit [www.slu.edu/financial-aid](http://www.slu.edu/financial-aid) (<https://www.slu.edu/financial-aid/>).

## Accreditation

The aerospace engineering, biomedical engineering, civil engineering, computer engineering, electrical engineering, and mechanical engineering undergraduate curricula are accredited by the Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org) (<https://www.abet.org>).

See Enrollment and Graduation Data for Electrical Engineering ([https://www.slu.edu/science-and-engineering/\\_pdfs/2018-electrical-engineering-enrollment-and-graduation-data.pdf](https://www.slu.edu/science-and-engineering/_pdfs/2018-electrical-engineering-enrollment-and-graduation-data.pdf))

## Learning Outcomes

The undergraduate electrical engineering program is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org> (<http://www.abet.org/>)).

## Program Educational Objectives

The undergraduate program is designed to meet the following specific program educational objectives:

- Our graduates will have acquired advanced degrees or are engaged in advanced study in engineering, business, law, medicine or other appropriate fields.
- Our graduates will have established themselves as practicing engineers in electrical, computer or related engineering fields.
- Our graduates will be filling the technical needs of society by solving engineering problems using electrical or computer engineering principles, tools and practices.

## Student Outcomes

Student outcomes are defined by ABET as the skills that graduates will attain at the time of graduation. Student outcomes are listed below:

An ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

## Requirements

Code	Title	Credits
<b>University Undergraduate Core (<a href="https://catalog.slu.edu/academic-policies/academic-policies-procedures/university-core/">https://catalog.slu.edu/academic-policies/academic-policies-procedures/university-core/</a>)</b> 32-35		
<b>Basic Engineering and Communication</b>		
SE 1700	Engineering Fundamentals	2
ECE 1001	Introduction to Electrical and Computer Engineering I	1
ENGL 1920	Advanced Writing for Professionals	3
<b>Basic Science and Mathematics</b>		
CHEM 1110 & CHEM 1115	General Chemistry I and General Chemistry I Laboratory	4
MATH 1510	Calculus I	4
PHYS 1610 & PHYS 1620	University Physics I and University Physics I Laboratory	4
PHYS 1630 & PHYS 1640	University Physics II and University Physics II Laboratory	4
MATH 1660	Discrete Mathematics	3
MATH 1520	Calculus II	4
MATH 2530	Calculus III	4
MATH 3550	Differential Equations	3
ECE 3052	Probability and Random Variables for Engineers	3
<b>Electrical Engineering</b>		
ECE 1100	Electrical Engineering 101	2
ECE 1200	Computer Engineering 101	2
ECE 2101 & ECE 2103	Electrical Circuits I and Electrical Circuits Lab	4
ECE 2205 & ECE 2206	Digital Design and Digital Design Lab	4
ECE 3225 & ECE 3226	Microprocessors and Microprocessors Laboratory	4
ECE 3130	Semiconductor Devices	3

ECE 3131 & ECE 3132	Electronic Circuit Design and Electronic Circuit Design Lab	4
ECE 3140	Electromagnetic Fields	3
ECE 3150 & ECE 3151	Linear Systems and Linear Systems Lab	4
ECE 3090	Junior Design	1
ECE 4800	Electrical and Computer Engineering Design I	3
ECE 4810	Electrical and Computer Engineering Design II	3

### Internship and Co-op

Although not required, students can elect to participate in an internship or cooperative experience before graduation.

Select from the following:

ECE 2910	Co-op in Electrical and Computer Engineering	0
ECE 3910	Co-op with Industry	
ECE 4910	Co-Op with Industry	
ECE 2915	Internship with Industry	
ECE 3915	Internship with Industry	
ECE 4915	Internship with Industry	

### Track or Concentration 32-38

Choose one:

Standard Track (p. 3)

Bioelectronics Concentration (Engineering Emphasis) (p. 4)

Bioelectronics Concentration (Pre-Health Emphasis) (p. 4)

### Total Credits 128-137

## Standard Track

Code	Title	Credits
MATH 3110	Linear Algebra for Engineers	3
MENG 2310	Thermodynamics	3
CSCI 1300	Introduction to Object-Oriented Programming	4
ECE 3110	Electric Energy Conversion	3
ECE 4120	Automatic Control Systems	3
ECE 4140	Electromagnetic Waves	3
ECE 4160	Communication Systems	3
<b>ECE Electives</b>		6
Students are required to take six (6) credits from an approved list and as offered. A partial list is given below. Please check with the program for a complete list of approved electives. Electives cannot be used to satisfy other curriculum requirements.		
ECE 3217	Computer Architecture and Organization	
ECE 4170	Energy Technologies I	
ECE 4110	Power Systems Analysis I	
ECE 4153	Image Processing	
ECE 4226	Mobile Robotics	
ECE 4132	Analog Integrated Circuit Design	
ECE 4235	Digital IC Design	
ECE 4141	Radar Systems	
ECE 4245	Computer Networks Design	
ECE 4150	Filter Design	
ECE 4151	Digital Signal Processing	
ECE 4161	Satellite Communication	
ECE 4162	Cellular Communications	

Technical Electives<sup>1</sup>

6

Select two 3-credit courses.

**Total Credits** 34**Bioelectronics Concentration**

Code	Title	Credits
BIOL 1240 & BIOL 1245	General Biology: Information Flow and Evolution and Principles of Biology I Laboratory	4
CHEM 1120 & CHEM 1125	General Chemistry 2 and General Chemistry 2 Laboratory	4
MENG 2310	Thermodynamics	3
MATH 3110	Linear Algebra for Engineers	3
ECE 4120	Automatic Control Systems	3
BME 2000	Biomedical Engineering Computing	3
BME 2200	Applied Physiology for Engineers	3
BME 3150	Biomedical Instrumentation	3
BME 4100	BioData Processing and Machine Learning	3

**BME or ECE Electives** 6

Students are required to take six (6) credits from an approved list and as offered. A partial list is given below. Please check with the program for a complete list of approved electives. Electives cannot be used to satisfy other curriculum requirements.

BME 4200	Biomechanics	
BME 4300	Biotransport	
BME 4400	Biomaterials	
BME 4410	Tissue Engineering	
BME 4600	Quantitative Physiology I	
BME 4150	Brain Computer Interface	
BME 4650	Quantitative Physiology II	
BME 4980	Independent Research	
ECE 4170	Energy Technologies I	
ECE 4110	Power Systems Analysis I	
ECE 4153	Image Processing	
ECE 4226	Mobile Robotics	
ECE 4132	Analog Integrated Circuit Design	
ECE 4235	Digital IC Design	
ECE 4141	Radar Systems	
ECE 4245	Computer Networks Design	
ECE 4150	Filter Design	
ECE 4151	Digital Signal Processing	
ECE 4161	Satellite Communication	
ECE 4162	Cellular Communications	

**Total Credits** 35**Pre-Health Concentration**

Code	Title	Credits
BIOL 1240 & BIOL 1245	General Biology: Information Flow and Evolution and Principles of Biology I Laboratory	4
BIOL 1260 & BIOL 1265	General Biology: Transformations of Energy and Matter and Principles of Biology II Laboratory	4
CHEM 1120 & CHEM 1125	General Chemistry 2 and General Chemistry 2 Laboratory	4
CHEM 2410 & CHEM 2415	Organic Chemistry 1 and Organic Chemistry 1 Laboratory	4

CHEM 2420 & CHEM 2425	Organic Chemistry 2 and Organic Chemistry 2 Laboratory	4
CHEM 3600	Principles of Biochemistry	3
PSY 1010	General Psychology	3
SOC 1100	Introduction to Sociology	3
BME 2000	Biomedical Engineering Computing	3
BME 2200	Applied Physiology for Engineers	3
<b>BME or ECE Electives</b>		3

Students are required to take three (3) credits from an approved list and as offered. A partial list is given below. Please check with the program for a complete list of approved electives. Electives cannot be used to satisfy other curriculum requirements.

BME 3150	Biomedical Instrumentation	
BME 4100	BioData Processing and Machine Learning	
BME 4200	Biomechanics	
BME 4300	Biotransport	
BME 4400	Biomaterials	
BME 4410	Tissue Engineering	
BME 4600	Quantitative Physiology I	
BME 4650	Quantitative Physiology II	
BME 4980	Independent Research	
ECE 3110	Electric Energy Conversion	
ECE 4225	Hardware/Software Co-Design	
ECE 4226	Mobile Robotics	
ECE 4235	Digital IC Design	

**Total Credits** 38**Non-Course Requirements**

All Science and Engineering B.A. and B.S. students must complete an exit interview/survey near the end of their bachelor's program.

**Continuation Standards**

Students must maintain a minimum 2.00 GPA

- <sup>1</sup> Two 3-credit courses selected from an approved list in science, mathematics, Computer Science, or engineering, at the 2000-level or higher.

**Roadmap**

Roadmaps are recommended semester-by-semester plans of study for programs and assume full-time enrollment unless otherwise noted.

Courses and milestones designated as critical (marked with !) must be completed in the semester listed to ensure a timely graduation. Transfer credit may change the roadmap.

This roadmap should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor/mentor each semester. Requirements, course availability and sequencing are subject to change.

Course	Title	Credits
<b>Year One</b>		
<b>Fall</b>		
ECE 1001	Introduction to Electrical and Computer Engineering I	1

SE 1700	Engineering Fundamentals	2
CHEM 1110 & CHEM 1115	General Chemistry I and General Chemistry I Laboratory	4
ENGL 1920	Advanced Writing for Professionals <sup>1</sup>	3
MATH 1510	Calculus I	4
ECE 1100	Electrical Engineering 101	2
CORE	Equity and Global Identities: Identities in Context	0-3

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**Credits** **16-19**

**Spring**

CSCI 1300	Introduction to Object-Oriented Programming	4
MATH 1660	Discrete Mathematics	3
MATH 1520	Calculus II	4
! PHYS 1610 & PHYS 1620	University Physics I and University Physics I Laboratory	4
ECE 1200	Computer Engineering 101	2
CORE 2500	Cura Personalis 2: Self in Contemplation	0

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**Credits** **17**

**Year Two****Fall**

! ECE 2101 & ECE 2103	Electrical Circuits I and Electrical Circuits Lab	4
CORE 1200	Eloquentia Perfecta 2: Oral and Visual Communication	3
MATH 2530	Calculus III	4
PHYS 1630 & PHYS 1640	University Physics II and University Physics II Laboratory	4
CORE	Equity and Global Identities: Global Interdependence	0-3

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**Credits** **15-18**

**Spring**

ECE 2205 & ECE 2206	Digital Design and Digital Design Lab	4
MATH 3110	Linear Algebra for Engineers	3
MATH 3550	Differential Equations	3
MENG 2310	Thermodynamics	3
ECE 3052	Probability and Random Variables for Engineers	3
CORE	Equity and Global Identities: Dignity, Ethics, and a Just Society	0-3

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**Credits** **16-19**

**Year Three****Fall**

ECE 3110	Electric Energy Conversion	3
ECE 3225 & ECE 3226	Microprocessors and Microprocessors Laboratory <sup>3</sup>	4
ECE 3130	Semiconductor Devices	3
! ECE 3150 & ECE 3151	Linear Systems and Linear Systems Lab <sup>3</sup>	4
CORE 3600	Ways of Thinking: Social and Behavioral Sciences	3
CORE 3500	Cura Personalis 3: Self in the World	1

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**Credits** **18**

**Spring**

ECE 3131 & ECE 3132	Electronic Circuit Design and Electronic Circuit Design Lab	4
ECE 3090	Junior Design	1
ECE 4120	Automatic Control Systems	3
ECE 3140	Electromagnetic Fields	3
ECE 4160	Communication Systems <sup>9</sup>	3
CORE 2800	Eloquentia Perfecta 3: Creative Expression	2-3

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**Credits** **16-17**

**Year Four****Fall**

ECE 4800	Electrical and Computer Engineering Design I <sup>5</sup>	3
CORE 1700	Ultimate Questions: Philosophy	3
ECE 4140	Electromagnetic Waves	3
ECE Elective <sup>6</sup>		3
Technical Elective <sup>7</sup>		3
CORE	Eloquentia Perfecta: Writing Intensive	0-3

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**Credits** **15-18**

**Spring**

ECE 4810	Electrical and Computer Engineering Design II	3
CORE 3400	Ways of Thinking: Aesthetics, History, and Culture	3
CORE 1600	Ultimate Questions: Theology	3
ECE Elective <sup>6</sup>		3
CORE 4500	Reflection-in-Action	0
CORE 4000	Collaborative Inquiry	0-3
Technical Elective <sup>7</sup>		3

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**Credits** **15-18**

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**Total Credits** **128-144**

<sup>1</sup> Students needing prerequisite work in writing skills as determined by ACT or SAT scores will be required to take ENGL 1500 The Process of Composition (3 cr)

<sup>2</sup> Must be taken from a list of approved courses in Social and Behavioral Science including Economics

<sup>3</sup> Prerequisite requirement of computer programming, either CSCI 1060 Introduction to Computer Science: Scientific Programming (3 cr), CSCI 1300 Introduction to Object-Oriented Programming (4 cr), or BME 2000 Biomedical Engineering Computing (3 cr)

<sup>4</sup> Courses satisfying another major or minor, or a course satisfying the technical elective requirement

<sup>5</sup> *Requires senior standing* (all required technical courses through the junior year have been completed and passed)

<sup>6</sup> Must be taken from the approved list of ECE elective courses

<sup>7</sup> Must be selected from courses in science, math, computer science, or engineering at the 2000 level or higher.

<sup>8</sup> Cannot be used to satisfy another core requirement

<sup>9</sup> ECE 4160 Communications is only taught every other year.