

# ELECTRICAL ENGINEERING, B.S.

The program offers a unique undergraduate program culminating in a Bachelor of Science in electrical engineering. The curriculum provides graduates with the necessary skills for entry into the profession as productive and effective engineers or for pursuing graduate school.

Additionally, the program ensures all students are exposed to entrepreneurship and the entrepreneurial mindset through the curriculum and extracurricular opportunities.

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 of Parks College of Engineering, Aviation and Technology. The course of study combines science and engineering, incorporating courses in biology, chemistry, math, biomedical engineering, electrical and electronic engineering, and others. Students in the Bioelectronics track will pursue either of two emphases, engineering or pre-health, and will graduate with a B.S. in Electrical Engineering and coursework in Biomedical Engineering.

## Curriculum Overview

The 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

Benefits of the electrical engineering program also include several internship and career opportunities. Students are encouraged and assisted in obtaining summer internships in local and global companies through career services. Undergraduate research opportunities within the college are available during the summer or regular semesters.

Students are also encouraged to seek research opportunities with faculty of the program or faculty in other programs.

## Careers

As an electrical engineer, there are a variety of career paths available to you, including industrial or consulting positions. Students are also

prepared for graduate and professional schools such as law, business administration or medicine.

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

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

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.

## Admission Requirements 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 course work is a primary concern in reviewing a freshman applicant's file. College admission test scores (ACT or SAT) are used as an additional indicator of the student's ability to meet the academic rigors of Saint Louis University and are used as qualifiers for certain University scholarship programs. To be considered for admission to any Saint Louis University undergraduate program, the applicant must be graduating from an accredited high school or have an acceptable score on 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. An official high school transcript and official test scores are required only of those students who have attempted fewer than 24 transferable semester credits (or 30 quarter credits) of college credit. Those having completed 24 or more of college credit need only submit a transcript from 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.

## International Applicants

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

- Demonstrate English Language Proficiency (<http://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, Parks College engineering programs have the following additional requirements:

- GPA: Minimum cumulative 3.00 high school GPA for freshmen applicants and 2.70 college GPA for transfer applicants.
- ACT/SAT: ACT composite score of 24 or higher, or SAT composite score of 1160 or higher. ACT sub scores minimums of 22 in English, 24 in Mathematics, 22 in Reading Comprehension and 22 in Scientific Reasoning, or SAT Math sub score of 620.
- 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 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 requirements to Parks College of Engineering, Aviation and Technology degree programs are based on a combination of secondary school grades, college admission test scores, co-curricular activities and attempted college course work, 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.

## Scholarships and Financial Aid

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

- Scholarships: awarded based on academic achievement, service, leadership and financial need.
- Financial Aid: provided in the form of grants and loans, some of which require repayment.

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

For information on other scholarships and financial aid, visit the student financial services office online at <http://finaid.slu.edu>.

## Accreditation

The Aerospace Engineering, Biomedical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Engineering Physics

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>).

Enrollment and graduation data for electrical engineering is listed here (<https://www.slu.edu/parks/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>).

### 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 apply knowledge of mathematics, science, and engineering;
- an ability to design and conduct experiments, as well as to analyze and interpret data;
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- an ability to function on multi-disciplinary teams;
- an ability to identify, formulate, and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global and societal context;
- a recognition of the need for, and an ability to engage in life-long learning;
- a knowledge of contemporary issues;
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Requirements

### Standard Track

Code	Title	Credits
<b>Basic Science and Mathematics Requirements</b>		
CHEM 1110 & CHEM 1115	General Chemistry 1 and General Chemistry 1 Laboratory	4
PHYS 1610 & PHYS 1620	Engineering Physics I and Engineering Physics I Laboratory	4
PHYS 1630 & PHYS 1640	Engineering Physics II and Engineering Physics II Laboratory	4
MATH 1660	Discrete Mathematics	3

MATH 1510	Calculus I	4
MATH 1520	Calculus II	4
MATH 2530	Calculus III	4
MATH 3110	Linear Algebra for Engineers	3
MATH 3550	Differential Equations	3
ECE 3052	Probability and Random Variables for Engineers	3
ESCI 2300	Thermodynamics	3

**Communication Skills**

ENGL 1920	Advanced Writing for Professionals	3
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**Computer Science**

CSCI 1060	Introduction to Computer Science: Scientific Programming	3
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**Liberal Arts Requirements**

PHIL 3400	Ethics & Engineering	3
THEO 1000	Theological Foundations	3
Cultural Diversity <sup>1</sup>		3
Humanities <sup>1</sup>		3
Social & Behavioral Science <sup>1</sup>		3

**Electrical Engineering Core**

ECE 1001	Introduction to Electrical and Computer Engineering	1
ECE 1002	Introduction to ECE II	1
ECE 2101	Electrical Circuits I	3
ECE 2102	Electrical Circuits II	3
ECE 2103	Electrical Circuits Lab	1
ECE 2205 & ECE 2206	Digital Design and Digital Design Lab	4
ECE 3110	Electric Energy Conversion	3
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 4120	Automatic Control Systems	3
ECE 4140	Electromagnetic Waves	3
ECE 4160	Communication Systems	3
ECE 4800	ECE Design I	3
ECE 4810	ECE Design II	3

**ECE Electives**

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	

**Open Elective**

Select one 3-credit course <sup>2</sup>	3
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**Technical Elective**

Select two 3-credit courses <sup>3</sup>	6
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**Internship and Co-op**

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

Select from the following: 0

ECE 2910	Co-op in ECE	
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	

**Concentrations**

Bioelectronics Concentration (Engineering Emphasis) (p. 3)	
Bioelectronics Concentration (Pre-Health Emphasis) (p. 4)	

Total Credits	125
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- <sup>1</sup> Cultural Diversity, Humanities, Social and Behavioral Science must be selected from an approved list.
- <sup>2</sup> One 3-credit course satisfying another minor/major or must satisfy the requirements of a technical elective.
- <sup>3</sup> Two 3-credit courses selected from an approved list in science, mathematics, Computer Science, or engineering, at the 2000-level or higher.

**Bioelectronics Concentration (Engineering Emphasis)**

Code	Title	Credits
<b>Basic Science and Mathematics Requirements</b>		
BIOL 1240 & BIOL 1245	Principles of Biology I and Principles of Biology I Laboratory	4
BIOL 1260 & BIOL 1265	Principles of Biology II and Principles of Biology II Laboratory	4
BIOL 2600	Human Physiology	3
CHEM 1110 & CHEM 1115	General Chemistry 1 and General Chemistry 1 Laboratory	4
CHEM 1120 & CHEM 1125	General Chemistry 2 and General Chemistry 2 Laboratory	4
PHYS 1610 & PHYS 1620	Engineering Physics I and Engineering Physics I Laboratory	4
PHYS 1630 & PHYS 1640	Engineering Physics II and Engineering Physics II Laboratory	4
MATH 1660	Discrete Mathematics	3
MATH 1510	Calculus I	4
MATH 1520	Calculus II	4
MATH 2530	Calculus III	4
MATH 3110	Linear Algebra for Engineers	3

MATH 3550	Differential Equations	3
ECE 3052	Probability and Random Variables for Engineers	3
<b>Written and Oral Communication</b>		
ENGL 1920	Advanced Writing for Professionals	3
<b>Liberal Arts Requirements</b>		
PHIL 3400	Ethics & Engineering	3
THEO 1000	Theological Foundations	3
Cultural Diversity <sup>1</sup>		3
Humanities <sup>1</sup>		3
Social & Behavioral Science <sup>1</sup>		3
<b>Electrical Engineering Core</b>		
ECE 1001	Introduction to Electrical and Computer Engineering	1
ECE 1002	Introduction to ECE II	1
ECE 2101	Electrical Circuits I	3
ECE 2102	Electrical Circuits II	3
ECE 2103	Electrical Circuits Lab	1
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 4120	Automatic Control Systems	3
ECE 4800	ECE Design I	3
ECE 4810	ECE Design II	3
<b>Biomedical Engineering Core</b>		
BME 2000	BME Computing	3
BME 3150	Biomedical Instrumentation	3
BME 4100	Biomedical Signals	3
<b>BME or ECE Electives</b>		
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.		6
BME 4200	Biomechanics	
BME 4300	Biotransport	
BME 4310	Advanced topics in Biotransport	
BME 4400	Biomaterials	
BME 4410	Tissue Engineering	
BME 4500	Numerical Methods in BME	
BME 4600	Quantitative Physiology I	
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	
<b>Internship and Co-op</b>		
Although not required, students can elect to participate in an internship or cooperative experience before graduation.		
Select from the following:		0
ECE 2910	Co-op in ECE	
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	
Total Credits		125

<sup>1</sup> Cultural Diversity, Humanities, Social and Behavioral Science must be selected from an approved list.

## Bioelectronics Concentration (Pre-Health Emphasis)

Code	Title	Credits
<b>Basic Science and Mathematics Requirements</b>		
BIOL 1240 & BIOL 1245	Principles of Biology I and Principles of Biology I Laboratory	4
BIOL 1260 & BIOL 1265	Principles of Biology II and Principles of Biology II Laboratory	4
CHEM 1110 & CHEM 1115	General Chemistry 1 and General Chemistry 1 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
PHYS 1610 & PHYS 1620	Engineering Physics I and Engineering Physics I Laboratory	4
PHYS 1630 & PHYS 1640	Engineering Physics II and Engineering Physics II Laboratory	4
MATH 1660	Discrete Mathematics	3
MATH 1510	Calculus I	4
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>Written and Oral Communication</b>		
ENGL 1900	Advanced Strategies Of Rhetoric and Research	3
<b>Liberal Arts Requirements</b>		
PHIL 3400	Ethics & Engineering	3
THEO 1000	Theological Foundations	3

Cultural Diversity <sup>1</sup>		3
Humanities	English Literature Elective <sup>1</sup>	3
PSY 1010	General Psychology	3
SOC 1100	Introduction to Sociology	3

<b>Electrical Engineering Core</b>		
ECE 1001	Introduction to Electrical and Computer Engineering	1
ECE 1002	Introduction to ECE II	1
ECE 2101	Electrical Circuits I	3
ECE 2102	Electrical Circuits II	3
ECE 2103	Electrical Circuits Lab	1
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 4120	Automatic Control Systems	3
ECE 4800	ECE Design I	3
ECE 4810	ECE Design II	3

<b>Biomedical Engineering Core</b>		
BME 2000	BME Computing	3

**BME or ECE Electives**  
 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 3150	Biomedical Instrumentation	
BME 4100	Biomedical Signals	
BME 4200	Biomechanics	
BME 4300	Biotransport	
BME 4310	Advanced topics in Biotransport	
BME 4400	Biomaterials	
BME 4410	Tissue Engineering	
BME 4500	Numerical Methods in BME	
BME 4600	Quantitative Physiology I	
BME 4650	Quantitative Physiology II	
BME 4980	Independent Research	
ECE 3110	Electric Energy Conversion	
ECE 3140	Electromagnetic Fields	
ECE 4225	Hardware/Software Co-Design	
ECE 4226	Mobile Robotics	
ECE 4235	Digital IC Design	
ECE 4151	Digital Signal Processing	

Total Credits 127

## Continuation Standards

Students must maintain a minimum 2.00 GPA

## 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	1
CHEM 1110 & CHEM 1115	General Chemistry 1 and General Chemistry 1 Laboratory	4
ENGL 1920	Advanced Writing for Professionals <sup>1</sup>	3
MATH 1510	Calculus I	4
THEO 1000	Theological Foundations	3
Credits		15
<b>Spring</b>		
ECE 1002	Introduction to ECE II	1
CSCI 1060	Introduction to Computer Science: Scientific Programming	3
MATH 1660	Discrete Mathematics	3
MATH 1520	Calculus II	4
PHYS 1610 & PHYS 1620	Engineering Physics I and Engineering Physics I Laboratory	4
Credits		15
<b>Year Two</b>		
<b>Fall</b>		
ECE 2101	Electrical Circuits I	3
ECE 2205 & ECE 2206	Digital Design and Digital Design Lab	4
MATH 2530	Calculus III	4
PHYS 1630 & PHYS 1640	Engineering Physics II and Engineering Physics II Laboratory	4
Credits		15
<b>Spring</b>		
ECE 2102 & ECE 2103	Electrical Circuits II and Electrical Circuits Lab	4
MATH 3110	Linear Algebra for Engineers	3
MATH 3550	Differential Equations	3
ESCI 2300	Thermodynamics	3
Core: Social & Behavioral Science <sup>2</sup>		3
Credits		16

<sup>1</sup> Cultural Diversity, Humanities, Social and Behavioral Science must be selected from an approved list.

**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
Open Elective <sup>4</sup>		3
Credits		17

**Spring**

ECE 3052	Probability and Random Variables for Engineers <sup>3</sup>	3
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
PHIL 3400	Ethics & Engineering	3
Credits		17

**Year Four****Fall**

ECE 4800	ECE Design I <sup>5</sup>	3
ECE 4160	Communication Systems	3
ECE 4140	Electromagnetic Waves	3
ECE Elective <sup>6</sup>		3
Technical Elective <sup>7</sup>		3
Credits		15

**Spring**

ECE 4810	ECE Design II	3
Core: Humanities <sup>8</sup>		3
Core: Cultural Diversity <sup>8</sup>		3
ECE Elective <sup>6</sup>		3
Technical Elective <sup>7</sup>		3
Credits		15
Total Credits		125

<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) and perhaps ENGL 1040 Accelerated Reading (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 BME 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, or engineering at the 2000 level or higher, or Computer Science at 3000 level or higher

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