

# ELECTRICAL ENGINEERING (EE)

## EE 1008 Introduction to the Everyday Aspects of Electrical Energy (1 Credit)

This course will introduce students to the fundamental concepts of electrical energy relevant for everyday life using hands-on activities. Topics include electrical appliances, solar panels, energy saving technologies, and electrical safety. No prior electrical or engineering experience is needed.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%201008>)

## EE 1014 Electric Vehicle for Everyone (5 Credits)

This course provides an introduction to electric vehicle technology, including the basic concepts in green transportation such as vehicle and system design, battery storage, motors and charging infrastructure. Issues related to electric transportation are explored from different perspectives. The course will also discuss the intersection of the Christian faith and technology. No prior electrical or engineering experience is needed.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%201014>)

## EE 1210 Introduction to Logic System Design (5 Credits)

Introduction to digital logic design including combinational and sequential logic design with Computer Aided Design (CAD) using a hardware description language. Combinational logic covers truth tables, Boolean algebra, logic gates, circuit minimization, multiplexers, decoders, encoders, programmable logic and more. Sequential logic covers latches, flip-flops, clocks, registers, counters, memories, CPLDs, FPGAs and more. Emphasis is placed on design techniques. Laboratory exercises include designs using both discrete gates and programmable devices.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%201210>)

## EE 1502 Electrical and Computer Engineering Fundamentals (1 Credit)

This hands-on course introduces students to basic hardware and software platforms commonly used by electrical engineers and computer Engineers. Typically offered: Autumn, Spring, Winter.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%201502>)

## EE 2502 Selected Circuits Topics for Transfer Students (2 Credits)

Prereq: An approved circuits 1 course transferred in. This course is required for all transfer electrical engineering and computer engineering students who do not take EE 2726 and SPU or do not transfer in a fully equivalent course. This course provides instruction on circuits concepts, software, and hardware that are utilized in the circuits labs at Seattle Pacific University, but which are normally not covered in Circuits 1 courses elsewhere. Typically offered: Autumn.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%202502>)

## EE 2726 Electric Circuits I (5 Credits)

Study of Basic Ohm's and Kirchhoff's laws with voltage/current sources. Preliminary introduction to nodal and mesh analysis, maximum power transfer, and Thevenin's theorem. Introduction to operational amplifiers, ideal transformers, inductance, capacitance, first-order circuits (both DC and AC) and first order frequency response. Includes lab problems, a short design project, and introduction to circuit simulation software. The first of a three-course sequence in which the engineer as servant is discussed. Typically Offered: Autumn, Spring.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%202726>)

## EE 2726L Electric Circuits I Lab (0 Credit)

Lab Component of EE 2726.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%202726L>)

## EE 2727 Electric Circuits II (4 Credits)

Introduction to source transformations and superposition. Additional work with nodal and mesh analysis, power transfer, and both Thevenin's and Norton's theorems. Introduction to second-order circuits (both DC and AC), including resonance, higher-order Bode plots, complex power and balanced three-phase power. Includes lab problems, short design project, circuit simulation and MATLAB.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%202727>)

## EE 2727L Electric Circuits II Lab (0 Credit)

Lab Component of EE 2727.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%202727L>)

## EE 2728 Electric Circuits II - Expanded (5 Credits)

Introduction to source transformations, superposition, and RMS voltages and currents. Additional work with nodal and mesh analysis, power transfer, and both Thevenin's and Norton's theorems with dependent sources. Introduction to second-order circuits (both DC and AC), including resonance, higher-order Bode plots, active filters, and higher order filters. Includes lab problems, design project, circuit simulation and MATLAB. Extra Fee. (Students cannot take both EE 2727 and EE 2728 for credit.) Typically offered: Winter.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%202728>)

## EE 3028 Electric Circuits III (4 Credits)

Introduction to active analog filtering, Laplace transforms, pole-zero concepts, state variable analysis, transformers, and two-port theory. The lab portion includes the use of circuit simulation, and MATLAB. Includes a significant team-based design project. Typically Offered: Spring.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203028>)

## EE 3028L Electric Circuits III Lab (0 Credit)

Lab Component of EE 3028.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203028L>)

**EE 3280 Microcontroller System Design (5 Credits)**

Design of hardware and software for embedded systems using a modern microcontroller. Covers hardware interfacing, interrupt interfacing, and use of internal and external peripheral devices. Emphasis is placed on programming of the microcontroller including device drivers, exception and interrupt handling, and interfacing with higher-level languages. Laboratory exercises require programming and hardware design.

Typically offered: Spring.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203280>)

**EE 3315 Electricity and Magnetism I (3 Credits)**

The first of a two-course sequence, this course studies electrostatics, magnetostatics, boundary conditions, electromagnetic waves, and introduction to applications.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203315>)

**EE 3410 Signal and System Analysis (5 Credits)**

Characterization of linear systems by impulse response, convolution and transfer function. Study of linear differential equations and linear difference equations as models. Study of continuous and discrete signals including filters and their effects. Uses transform methods including Fourier series and transforms, FFT, Laplace transforms and Z transforms. Includes computer problems. Typically offered: Autumn.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203410>)

**EE 3500 Power Systems Fundamentals (5 Credits)**

Principles of electric power systems, three-phase power generation, transmission and distribution systems, modeling, power-flow solutions, sequence network and fault analysis. Energy, environment, safety, and electric code standards. Practical training in design, material and component selection for commercial and industrial applications.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203500>)

**EE 3501 Power Systems Applications (5 Credits)**

Introduces the fundamentals of three phase power distribution and operation, including sizing electrical services to buildings and performing voltage drop calculations. Students will develop a basic intuition about magnetic fields with regards to transformers, generators, and motors. Students will design a three-phase system and the relay logic controls for a machine tool. The course will also introduce code compliance and local enforcing agencies. Students will learn to size transformers, motors, branch circuits, protection devices, and feeders, as well as perform short circuit calculations. Students will gain an understanding about electrical safety and arc faults. AutoCAD will be used to design an electrical plan for a commercial building, including calculation submittals, lighting plans, and power plans. Typically offered: Winter, Occasionally.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203501>)

**EE 3510 Power Electronics Fundamentals (5 Credits)**

Studies technologies and techniques used to control the conversion and flow of electrical power in the context of the larger issues of electric energy use and society, and the role of Power Electronics in Smart Cities. Studies semiconductor switching devices and their central role in efficient power conversion, utility input rectification (AC-DC), switch mode DC-DC, AC-AC, and DC-AC conversion, including application to motor drives, UPS, electromagnetic interference and switch-mode DC power supplies. Includes the design of feedback controllers and Soft Switching. Includes laboratory exercises.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203510>)

**EE 3520 Microgrids (3-5 Credit)**

A foundational course on microgrids with an emphasis on community-based solutions and natural disasters response. Provides critical skills to successfully evaluate and design microgrid systems and related topics such as renewable energy resources, distributed generation, energy storage systems, transportation electrification, flexible resources, monitoring and control systems, and management techniques.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203520>)

**EE 3550 Communication System Analysis (5 Credits)**

An introduction to principles of modern communication systems with an emphasis on current technological applications. Covers basics such as transmission media, analog and digital signaling techniques, computer communication, TCP/IP network architecture, data encoding methods and multiplexing mechanisms. Modern communication protocols for networks are analyzed. High-level issues such as security and encryption are studied.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203550>)

**EE 3721 Electronics I - Analog Devices and Circuits (5 Credits)**

Study of electronic devices and basic circuit configurations. Topics covered include semiconductors, diodes, AC to DC conversion, amplifier principles, bipolar junction transistors, BJT amplifiers, frequency response, MOS field effect transistors, digital circuits, output stages and power amplifiers, and differential amplifiers. Includes lab problems. Typically Offered: Winter.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203721>)

**EE 3721L Electronics I - Analog Devices and Circuits Lab (1 Credit)**

Lab Component of EE 3721. Typically offered: Winter.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203721L>)

**EE 3722 Electronics II Analog Electronics (5 Credits)**

Studies field effect transistors, FET amplifiers, frequency response, feedback, operational amplifiers, op-amp circuit design, Integrated-Circuit and multistage amplifiers, wide-band gap semiconductors, and introduces power electronics and PCB design. Introduces formal design documentation via lab experience. Typically Offered: Spring.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203722>)

**EE 3722L Electronics II Analog Electronics Lab (1 Credit)**

Lab Component of EE 3722. Typically offered: Autumn.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203722L>)

**EE 3730 Engineering Design (5 Credits)**

Team design and construction of industrial or self-designed projects. Typical projects require analog and digital electronic circuit design, development, construction and testing as well as teaming with General Engineering students taking EGR 3810. Required components include formal documentation and the use of project management tools and principles, and the conduction of design reviews. Interdisciplinary projects are encouraged. All projects require oral and written reports.

Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203730>)

**EE 3760 Computer Organization and Assembly Language (5 Credits)**

Study of organization and structuring of the major hardware components of computers. Includes mechanics of information transfer and control within a digital computer system. Introduces computer architecture, machine instruction sets and assembly language programming.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%203760>)

**EE 4211 Electrical Engineering Senior Design I (3 Credits)**

Study of mixed digital and analog system design, including embedded software design. Student teams begin a system level design of a project (a nondisclosure agreement may be required). Students provide detailed schedules for building prototype systems and present periodic progress reports. During the course, students produce technical specifications, undergo design reviews and design a proof of concept system. Typically offered: Autumn.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204211>)

**EE 4212 Electrical Engineering Senior Design II (3 Credits)**

Continued study of mixed digital and analog system design, including embedded software design. Student teams continue to implement and refine the prototype hardware and software designs from EE/CPE 4211. Teams write detailed technical reports and submit their designs to design reviews. Periodic progress reports and team presentations are required.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204212>)

**EE 4311 Optics and Lasers (5 Credits)**

General theory of geometrical optics, physical optics, fiber optics and optical devices. Lectures and laboratory each week. Typically offered: Alternate Years.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204311>)

**EE 4410 Embedded and Fixed Point Digital Signal Processing (3 Credits)**

Prerequisites: EE 3410 and (EE 3760 or CPE 3760 or CSC 3760). In this course, students will use embedded systems to implement signal-processing algorithms including convolution, FFT, IIR and FIR filters and others. Concepts will be modeled using a variety of methods and implemented using lower-level programming languages. Fixed-point systems will be studied and used to implement digital filters. The course will include a project integrating the course ideas.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204410>)

**EE 4450 Control System Design (5 Credits)**

Analog control system feedback analysis and design using root locus, frequency and PID methods to adjust stability and performance of the controlled systems. MATLAB is used extensively as a design tool. Typically offered: Winter.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204450>)

**EE 4560 Wireless Communication Systems (3 Credits)**

Students study radio frequency (RF) and other wireless communications systems with an emphasis on current methods and standards. Transmission and reception concepts including high- and low-gain antennas, power budget and analysis, attenuation, interference, fading and bandwidth are studied. Modern wireless communications protocols used for mobile telephones, computer networking and broadcast radio/television are explored in detail.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204560>)

**EE 4770 Fundamentals of Advanced Embedded Systems (3-5 Credit)**

This course builds on prior embedded systems coursework. Focus will be placed on the understanding and development of complex embedded systems. Specific topics to be covered include: detailing advanced wired and wireless communication protocols, developing application programming interfaces (APIs) for a variety of analog and digital sensors, and architecting for low power. The course is heavily lab-focused, culminating in a final project where students will present their designs to an industry panel. Typically offered: Autumn, Alternate Years.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204770>)

**EE 4899 Electrical Engineering Capstone and Senior Design (3 Credits)**

In this capstone course designs from EE 4212 are developed into a manufacturing prototype and tested. Covers testing methodology (hardware and software), debugging and documentation methodology. Teams author detailed technical documents. Periodic progress reports and final presentations are required. Includes study of vocation in engineering, writing reflective responses, and preparation of a portfolio of major projects students have finished.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204899>)

**EE 4900 Independent Study (1-5 Credit)**

Student works independently with a faculty member on a mutually agreed upon topic.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204900>)

**EE 4911 Washington State FE Preparation for Electrical Engineers (2 Credits)**

Seminar review of principles and problem solving in math, ethics, engineering economics, and computer/Electrical engineering technical topics to assist students in preparation for the Electrical Engineering FE exam.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204911>)

**EE 4930 Practicum in Electrical Engineering - Service (1-5 Credit)**

Practicum in electrical engineering that provides service to the university. Examples include academic support system and programming, tutoring, grading and lab preparation.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204930>)

**EE 4950 Topics in Electrical Engineering (1-5 Credit)**

An advanced course studying a special interest topic in electrical engineering. Topics and credits may vary between offerings.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204950>)

**EE 4960 Senior Project (1-5 Credit)**

Student works with faculty advisor on a mutually agreed upon project. Requires submission of application to EE chair three weeks prior to the start of the quarter.  
Course Schedule (<https://catalog.spu.edu/course-search/?details&code=EE%204960>)