

ECE4450 Course Syllabus

ECE4450

Analog Circuits for Music Synthesis (2-0-3-3)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Elective for the EE degree.

Lab Hours

0 supervised lab hours and 3 unsupervised lab hours

Course Coordinator

Lanterman, Aaron D

Prerequisites

ECE3043[min grade C] or ECE3741[min grade C] and ECE3084[min grade C]

Corequisites

None

Catalog Description

Circuits from classic analog synthesizers: voltage-controlled oscillators, filters, and amplifiers; nonlinear waveshapers. Operational transconductance amplifiers. Exploitation of dynamic resistance of semiconductors. Hands-on projects.

Textbook(s)

No Textbook Specified.

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Analyze circuits employing operational transconductance amplifiers.
2. Analyze linear and exponential voltage-to-current converters.
3. Analyze sawtooth-core and triangle-core voltage controlled oscillators.
4. Exploit the nonlinearities and dynamic resistance of semiconductor devices.
5. Analyze various voltage controlled filter configurations, such as Sallen-Key filters, state variable filters, and the Moog ladder filter.

Student Outcomes

In the parentheses for each Student Outcome:

"P" for primary indicates the outcome is a major focus of the entire course.

"M" for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.

"LN" for "little to none" indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. (LN) An ability to 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. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to 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. (LN) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (LN) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (LN) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

Historical perspective

Demonstration of a modular synthesizer

Circuit theory review (emphasis on operational amplifiers)

Operational transconductance amplifiers (OTAs)

 Voltage-controlled amplifiers

 Linear current sources

Voltage-controlled oscillators

 Sawtooth cores (comparators with resettable integrators)

 Temperature-compensated exponential current sources

 Triangle cores (comparators and integrators with current switches)

 Basic waveshaping circuits