

# ECE Course Outline

## ECE44xx - Analog Circuits for Music Synthesis (2-3-3)

**Prerequisites:** (ECE 3043 [min C] or ECE 3741 [min C]) and ECE 3084 [min 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.

### 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

    Complex waveshaping circuits for generating time-varying spectra

Voltage controlled filters (VCFs)

    Single-pole OTA-C VCFs (resistor replacement and "systems" viewpoints)

    Four-pole VCFs with feedback (pole migration and resonance peaks)

    Transistor-ladder and diode-ladder VCFs (dynamic resistance)

    Second-order filter properties

    State-variable VCFs

    Sallen-Key VCFs