ECE 146: Electronics II

Catalog description: 4.0 units

Op Amp circuits, waveform generation and shaping, sinusoidal oscillators, high frequency amplifiers, active filters, power supply regulators, power electronics, advanced linear ICs.

Prerequisites: ECE 145

Course objectives

1. Understand the characteristics and non-idealities of an operational amplifier
2. Analyze and design various operational amplifier circuits, oscillators, active filter
3. Learn circuit applications of voltage-to-frequency converters and phase-locked loops
4. Understand power supply circuits
5. Analyze high-frequency response of transistor circuits
6. Learn the characteristics and comparative advantages of power amplifiers
7. Introduce silicon controlled rectifiers

Course outcomes

Students shall be able to analyze:

1. Operational amplifier circuits with dual or single power supplies
2. Sinusoidal oscillators using Barkhausen criterion
3. Non-sinusoidal oscillators, including timer circuits
4. Active filter circuits with different types of filters
5. Voltage regulator and power supply circuits
6. High frequency transistor amplifiers using hybrid-pi models
7. Power amplifiers
8. Simple silicon controlled rectifier (SCR) circuits

Students shall be able to design:

1. Operational amplifier circuits with various mathematical operations
2. Schmitt trigger circuits with any given transfer characteristics
3. Sinusoidal oscillators, multi-vibrator and timer circuits
4. Active filter circuits with specifications given in frequency domain
5. Power supply circuits including the use of IC voltage regulators
6. Class-A and class-B power amplifier and high frequency transistor amplifiers

Topics covered

1. Non-idealities
2. Compensation
3. Operational amplifier circuits (inverting/non-inverting amplifiers, other circuits, differential amplifiers, V-I converters, Schmitt triggers, clipper and clamper circuits)
4. Diode-operational amplifier circuits (precision rectifiers, logarithmic amplifiers, peak detectors, sample and hold circuits)

5. Operational amplifier characteristics (Norton amplifier, sinusoidal oscillators, phase shift, Wien Bridge, LC Oscillators, quadrature)
6. Non-sinusoidal oscillators (multi-vibrators, 555 timer)
7. Active filters (transfer functions, VCVS and IGMF realizations, state variable realizations, switched capacitor filters)
8. Linear integrated circuits (V-F converters, phase-locked loops)
9. Voltage regulators (rectifiers and filters, linear voltage regulators, switching voltage regulators)
10. High frequency amplifiers (BJT small signal equivalent, 3-dB cutoff frequency, Miller Effect, FET model, tuned amplifiers)
11. Power amplifiers (Class A amplifiers, Class B amplifiers, Class C amplifiers, power dissipation and thermal considerations)
12. Thyristors (silicon controlled rectifier (SCR), uni-junction transistor (UJT))

Class/Laboratory schedule:

One hundred fifty minutes of lecture and one hundred fifty minutes of laboratory per week

Contribution of course to meet the professional component

This course contributes to the student's ability to work professionally analyzing and designing complex electrical and electronic devices.

Relationship of course to Mechatronic Engineering Program Outcomes

This course contributes principally to Program Outcomes A and B.