1. ECE 332: Electronics Principles II

2. 4 credits: 2-75 minute lecture sessions/week, 1-170 minute lab/week

3. Thomas Chen

4. Fundamentals of Microelectronics. Razavi, B. 2014.

5. Course Information
    a. Discrete and integrated-circuit amplifiers-frequency response, negative feedback; digital logic circuits
    b. Prerequisites: ECE 331 with a C or higher
    c. Required: Electrical Engineering; Lasers & Optical Engineering
       Selected Elective: Computer Engineering

6. Goals for the Course
    a. Course Learning Objectives
        i. Determine region of operation, bias points and equivalent circuits
        ii. Depict common gate, drain and source configurations
        iii. Analyze configurations for transfer functions of voltage, current and transconductance
        iv. Show relationship to open-circuit time constant and Miller effect approximation
        v. Simulate circuits and edit SPICE models so models match measurements
        vi. Design bias circuits in single and multi-stage amplifiers and optimize design for achieving fundamental specifications such as gain, bandwidth and output swing
        vii. Determine loop gain and the effect on stability described in terms of effects on poles for the circuit and phase margin
        viii. Describe common sources and characteristics of noise in linear and non-linear systems
        ix. Utilize first-order models for circuits
        x. Analyze common topologies for sinusoid pule and triangular waveform generation
    b. Student Outcomes
        1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
        2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and welfare, as well as global, cultural, social, environmental, and economic factors
        3. An ability to communicate effectively with a range of audiences
        4. 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. 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. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability acquire and apply new knowledge as needed, using appropriate learning strategies

7. Topics Covered

Review of MOS transistor characteristics
CMOS silicon process overview
CMOS small signal model overview
CMOS current sources
CMOS common source circuit
CMOS common gate circuit
CMOS source follower (common drain circuit)
CMOS differential circuits
CMOS output stage design
CMOS OTA and Opamp
Frequency response of CMOS circuits
Principle of feedback structures
Stability analysis and compensation
Noise analysis
Linear signal amplification, transfer functions and frequency response
Parasitic and secondary effects on signal processing
Linear amplifier operation and design
Feedback in linear and non-linear circuits
Noise and perturbations on signal integrity
Waveform generation and shaping