COURSE NUMBER: Ve311	**COURSE TITLE: Electronic circuits**
CREDIT: 4	**PREREQUISITES:** VE216
TEXTBOOKS/REQUIRED MATERIAL: R. Jaeger and Blalock, Microelectronic Circuit Design, 4th ed., McGraw-Hill, 2010	**PREPARED BY:** Jon Tomas Gudmundsson **DATE OF PREPARATION:** July 3, 2012 **DATE OF UC APPROVAL:** Oct. 30, 2013
INSTRUCTOR(S): Jon Tomas Gudmundsson	**SCIENCE/DESIGN:** n/a
CATALOG DESCRIPTION: Circuit models for bipolar junction and field-effect transistors; nonlinear elements; small-signal and piecewise analysis of nonlinear circuits; analysis and design of basic single-stage transistor amplifiers: gain, biasing, and frequency response; digital logic circuits; memory circuits (RAM, ROM). Design projects. Lecture and laboratory.	**COURSE TOPICS:** 1. Nonlinear circuit elements 2. Non-ideal op-amps and circuits 3. Small-signal modeling of nonlinear circuit devices 4. Gain, bandwidth, impedance 5. Transistor amplifier biasing 6. Small-signal analysis of nonlinear analog circuits 7. Piecewise-linear analysis of nonlinear analog circuits 8. Single-transistor amplifiers 9. Multi-transistor amplifiers

COURSE STRUCTURE/SCHEDULE: Lecture: twice per week, 90 minutes each; Laboratory: 5 times, 3 hrs

COURSE OBJECTIVES [Course Outcomes in brackets]	1. To teach students non-idealities (finite input and output resistances, finite gain and bandwidth, input offset voltage and current) in op-amps, and their effects on op-amp performance; [1] 2. To teach students nonlinear circuit elements such as transistors, diodes, and junction capacitors; [1, 2] 3. To teach students analysis techniques (small-signal analysis) for nonlinear circuits and devices; [1, 2, 3] 4. To teach students basic mixed-signal (analog and digital) circuits, such as oscillators and mixers; [2, 3, 4] 5. To teach students how to use basic simulation software for analog circuit analysis and design; [1, 2, 4] 6. To teach students how to design multi-transistor analog amplifiers meeting specifications such as: gain, bandwidth, input and output resistances, linearity and saturation limits. [1, 4]
COURSE OUTCOMES [Program Outcomes in brackets]	After completing Ve311, students should be able to: 1. Ability to reduce a nonlinear circuit to its small-signal equivalent and analyze it; [a] 2. Ability to determine the small-signal (hybrid-pi) model of a transistor from its data sheet and lab measurements using oscilloscopes, signal generators, and semiconductor parameter analyzers; [a,b,k] 3. Ability to design a digital ring oscillator with a voltage-controllable frequency meeting a given frequency specification; [a,c] 4. Ability to design and physically implement a transistor amplifier having a stable biasing circuit and meeting given design specifications such as gain, bandwidth, and node impedances. [a,c] 5. Ability to analyze feedback circuits containing non-ideal op-amps [a]

ASSESSMENT TOOLS [Course Outcomes in brackets]	Homework [1, 2,3, 4, 5] Two Midterm exams and a Final Exam [1, 2, 3, 4,5] Written reports [1, 2, 3, 4]