20-EECE-3071	**ELECTRONICS II**
Required/Elective:	Required for EE and CompE majors
Catalog Data:	20-EECE-3071.
Prereqs:	Electronics I, 20-EECE-2070
Prereqs by Topic:	FET and bipolar transistor amplifier biasing and small-signal equivalent circuits, amplifier configurations; amplifier gain, input and output impedances; single, differential and multistage amplifier analysis, operational amplifiers.
Textbook:	Donald A. Neamen, *Microelectronic Circuit Analysis and Design*, 4th Ed., McGraw Hill, 2010
References:	A.S. Sedra and K. C. Smith, *Microelectronic Circuits*, 6th Ed., Oxford Press, 2010 R.L. Boylestad, *Introductory Circuit Analysis*, 6th Ed., Merril, 1990 T.L. Floyd, *Electronic Devices, Electron-Flow Version*, 2nd Ed., Prentice Hall, 1996
Goals:	Students will learn basic analog circuit design including frequency response and feedback as well as digital circuit design including CMOS.
Topics:	1. Review of DC and small-signal electronic circuits and two-port parameters (h parameters) 2. Hybrid-π model, Common emitter configuration, Multistage amplifiers, Cascade configuration 3. High frequency response of amplifiers, Bode plots 4. Bypass capacitors, Miller Effect 5. Tuned amplifiers 6. Review of BJT differential pair, push-pull amplifiers, inductively coupled amplifiers 7. Feedback principles and basic feedback topologies 8. Feedback amplifier analysis and design, series-shunt configuration 9. Feedback amplifier stability analysis, phase and gain margins 10. Positive feedback and oscillators 11. Multivibrator, inductively coupled oscillators 12. Advanced amplifiers (cascade configuration) 13. Advanced feedback circuits, automatic gain control, automatic frequency control, phase-locked loops 14. Niquist plot, frequency and Miller compensation 15. Review of Op-amp operation 16. Active first and second order filters, Butterworth filters 17. Gyrator 18. Transistor switching 19. MOSFET review (n and p channels), DC analysis 20. MOSFET load lines and mode of operation 21. Bipolar transistor and digital circuit applications (RTL, TTL, ECL logic circuits), power-delay product analysis 22. MOSFET inverters and CMOS digital circuits, BiCMOS circuits, power-

	delay product analysis

Class Schedule:	Three 55-minute Classes each week
Computer Usage:	MATLAB for solution of equations and graphical analysis and B2Spice for circuit design
ABET Outcomes	a, c, e, and k
Course Learning Objectives:	Students will: 1. Get a basic understanding of DC and small signal model of BJT and FET devices and circuits 2. Get a basic knowledge of power amplifiers, multistage amplifiers, and differential amplifiers 3. Comprehend feedback amplifier operation, including four basic feedback amplifier configurations, gain at low and high frequencies, and capacitance effects 4. Comprehend and be able to analyze single-stage and multi-stage transistor amplifier operation, including amplifier stability, gain and phase margin, and pole mixing, and be able to construct Bode plots of the magnitude and phase of the gain 5. Comprehend and be able to analyze active filters, tuned amplifiers, and

	oscillators,including the use of operational amplifiers, reactive components, and positive feedback 6. Comprehend and be able to analyze digital bipolar circuits, digital inverters, and digital MOSFET circuits including NMOS and CMOS digital inverters 7. Complete a design for an analog or digital multistage circuit based on output/input specifications, including frequency response (switching speed), gain (noise margin), and system complexity, demonstrating competence in P-Spice and MATLAB.		
Contribution to Professional Component:	Engineering science: 2 credits (66%) Engineering design: 1 credit (34%)		
Prepared by:	**Prepared by** Marc Cahay, Ph.D.	**Date** July 12, 2010	revised: January 3, 2017
Approved by SECS Undergraduate Council:			