ECE 2210—Electronics I (3 –3)
Required Course

2006 - 2007 Catalog Data:
ECE 2210: Junction theory, semiconductor diode and models, bipolar transistors and models, field-effect transistors and models. Semiconductor circuits, biasing, and stabilization. Computer-aided design of single- and two-stage amplifiers. Principles and basic technology of MOS and bipolar digital and linear integrated circuits. Prerequisites: ECE 2100, PHYS 2070.

Textbooks:

Required:
A. S. Sedra and K. C. Smith, Microelectronics Circuits 4th Edition, Saunders College Publication., 1998.
M. Herniter., *Schematic Capture with Cadence PSpice*", 3rd Edition, Prentice-Hall, 2003

Reference:
Stanley G. Burns and Paul R. Bond, Principles of Electronics, 2nd Edition PWS Publishing Company, 1997.

Coordinator: Johnson Asumadu, Associate Professor, ECE

Instructor (Fall 2006/Spring 2007): Liang Dong, Assistant Professor**,** ECE

Prerequisites by topic:
1. Differentiation and Integration of single and multiple variable functions
2. Fundamentals of electricity and magnetism based on the study of physics
3. Analysis of linear electrical circuits using Kirchoff's, laws and network theorems, sinusoidal steady state analysis and transient analysis of RLC circuits.
4. Application of SPICE to the analysis of electrical networks.
5. Basic scientific laboratory measurement skills.

Course Objectives (ABET Learning Outcomes)
ABET learning outcome assigned to this course by ECE assessment place: e, f, and k
1. Usage of non-linear devices (diodes, BJTs, MOS and J FETs, simple ICs) in amplifier building, switches, logic circuits, shaping of waveforms, indicator designs, and integrated circuits. (*b, c, e, f, k*)
2. Translate non-linear devices into equivalent circuits that are composed of linear elements (equivalent resistance, equivalent capacitance, equivalent inductance, current sources, and voltage sources). (*a, b, e, k*)
3. Ability to specify design criteria (gain, input resistance, output resistance). (*a, b, c, e, f, g, k*)
4. How to read, locate, and interpret data from specification sheets/manuals. (*c, e, f, h, k*)
5. Ability to select components, interpret terminal characteristics of the components, model components, design circuit, and understanding operation of circuit. (*c, e, k*)
6. Draw circuit diagram of design. (*a, b, c, e, f, g, k*)
7. Learn how to use application software (PSPICE, MATLAB, MATHCAD) for simulating circuits with non-linear devices. (*a, b, c, e, i, k*)
8. Use of appropriate laboratory equipment (oscilloscopes, function generators, multimeters) to determine the output behavior expected from standard set of inputs (dc, sine wave, square wave, triangular). (*a, e, f*)
9. Test circuits and identify the likely failure modes and find ways to minimize the failures. (*a, c, e, f*)

Topics:
1. Basic semiconductor concepts – p-type, n-type, p-n junction, diodes (6 classes)
2. Diode v-i characteristics, diode circuits, models – piecewise, constant voltage drop, small-signal, ideal, Application – rectifiers, clamping, clipping, voltage regulation, Diode Types – LEDs, Optoisolators, Zener, and other types (9 classes)
3. BJT p-n-p and n-p-n Structures, Modes, Characteristics and Analysis, Small-Signal Circuits, Saturation and Switching (9 classes)
4. FET enhancement, depletion, MOSFETs, JFETs, Characteristics and Analysis, Small-signal circuits,

Biasing and Switching (9 classes)
5. Transistor Amplifier, Single-stage, Multi-stage, Differential Amplifiers. (5 classes)
6. Analog IC Concept - MOS and TTL (3 classes)

Laboratory Projects:
1. Introduction to Oscilloscpes Familiarization (1 Class)
2. Diode V-I Characteristics (1 Class)
3. PSpice Analysis of Diode Circuits (1 Class)
4. Diode Circuits (1 Class)
5. Load (Source) Lines and Dynamic Resistance (1 Class)
6. Zener Diode (1 Class)
7. BJT Characteristics (1 Class)
8. BJT Common-Emitter Inverter (1 Class)
9. BJT Amplifier Biasing (1 Class)
10. PSpice Analysis of BJT Inverter (1 Class)
11. MOSFET V-I Characteristics (1 Class)
12. Operational Amplifiers (1 Class)

Course/Laboratory: 3 hours of lectures and 3 hours of laboratory.

Evaluation:
1 Homework
1. Laboratory Quizzes
2. Laboratory Reports
3. Mid Term Exams
4. Final Exam

Contribution to Professional Component:
ABET category content as estimated by faculty member who prepared this course description:
Engineering sciences: 2 credits or 50%
Engineering design: 2 credits or 50%

Relation of Course to Program Outcomes:
This course provides significant support for:
EE and CE program objectives - depth, breadth, and professionalism
ECE expected learning outcomes - a, b, c, e, f, g, h, i, k

Prepared by: Johnson A. Asumadu Date: May 18, 2007