1. **Course number and name**: ECE 2210: Electronics I

2. **Credits and contact hours**: 4 credits and 6 hours

3. **Course coordinator**: Steven Durbin, Professor

4. **Text book**:
    a. Microelectronic Circuits w/CD , 6th edition, Sedra/Smith, 2010 (required)
    b. Schematic Capture w/ Cadence Pspice w/CD, 2nd edition, M Herniter, 2003
    c. ECE 2210 Laboratory Manual, Dept of Electrical and Computer Engineering, Western Michigan University
    d. SPICE circuit simulation software, e.g. LTSpice® PSpice® circuit simulation
    e. package
    f. MATLAB® and Simulink® mathematics software suite

5. **Course Information**
    a. 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.
    b. Prerequisites: ECE 2100 and PHYS 2070; with a grade of "C" or better in all prerequisites.
    c. Required

6. **Specific goals for the course**
    a. **Specific outcomes of instruction-**
        1. The student will learn usage of non-linear devices (diodes, BJTs, MOS and JFETs, simple ICs) in amplifier building switches, logic circuits, shaping of waveforms, indicator designs, and integrated circuits. (b,c,e,f,k)
        2. The student will learn to 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. The student will develop an ability to specify design criteria (gain, input resistance, output resistance). (a,b,c,e,f,g,k)
        4. The student will learn how to read, locate, and interpret data from specification sheets/manuals. (c,e,f,h,k)
        5. The student will develop an ability to select components, interpret terminal characteristics of the components, model components, design circuit, and understanding operation of circuit. (c,e,k)

6. The student will learn to draw circuit diagram of design. (a,b,c,e,f,g,k)
7. The student will learn how to use application software (PSPICE, MATLAB, MATHCAD) for simulating circuits with non-linear devices. (a,b,c,e,i,k)
8. The student will understand how to 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. The student will learn how to test circuits and identify the likely failure modes and find ways to minimize the failures. (a,c,e,f)

b. **ABET student outcome**: This course contributes to the attainment of the following student learning outcomes a, b, c, e, f, g, h, i and k. ABET learning outcomes e, f and k are directly assessed in this course.

7. Brief list of topics to be covered

- Basic semiconductor concepts, current flow in semiconductors, physical structure and operation of pn junction
- Terminal characteristics of ideal and junction diodes, diode circuits, diode modeling of forward characteristics, Zener diode, diode application- rectifiers, clamping, clipping, voltage regulation, Schottky-Barrier diode, photodiodes, light emitting diode (LED)
- Physical structure and operation of MOSFET, current-voltage characteristics of NMOS, PMOS, CMOS, MOS circuit DC analysis, small-signal operation and models, discrete MOSFET amplifier
- Physical structure and operation of BJT, current-voltage characteristics of npn BJT and pnp BJT, BJT circuit DC analysis, small-signal operation and models, discrete BJT amplifier
- p-n-p and n-p-n Structures, Modes, Characteristics and Analysis, Small-Signal Circuits, Saturation and Switching
- Analog concept- Transistor Amplifier, single-stage and multi-stage amplifiers
- Digital concept- digital inverter implemented by CMOS or BJT