

1. **Number and title of course:** EE 100 – Electronic Techniques for Engineering
2. **Course objectives:** EE 42/100 (and EE 43) serve as an introduction to the principles of Electrical Engineering, using electronic devices to communicate, solve problems, and manipulate our environment. EE 42/100 will start with basic concepts about charges and currents, develop devices such as circuits to translate design concepts into reality, and study some high level applications including logic circuits, amplifiers, power supplies, and communication links.
3. **Topics covered:**
 - Circuits, currents, and voltages; Power and energy; Kirchhoff's Current Law; Kirchhoff's Voltage Law; Introduction to circuit elements; Introduction to circuits
 - Resistive circuits; Thévenin and Norton equivalent circuits; Node/Mesh/Superposition analysis
 - Inductance and capacitance; L and C transients
 - Phasors; Frequency response; Bode plots; Resonance
 - Operational Amplifiers: Ideal operational amplifiers; Inverting and non-inverting amplifiers; Design of simple amplifiers; Op-amp imperfections in the linear range of operation; Integrators and differentiators;
 - Semiconductors
 - Diodes: Basic concepts; Load-line analysis of diode circuits; Ideal-diode model; Piecewise-linear diode models; Rectifier circuits
 - Amplifiers: Basic amplifier concepts; Cascaded amplifiers; Ideal amplifiers; Frequency response; Offset voltage, bias current, and offset current
 - MOSFET: NMOS and PMOS transistors; Load-line analysis of a simple NMOS amplifier; Bias circuits; Small-signal equivalent circuits; Common-source amplifiers; Source followers
 - Logic circuits: CMOS logic gates; flip-flops, registers, counters, adder
4. **Relationship of course to program objectives:**
 - a) Students are expected to apply basic principle of mathematics such as derivatives and integration to understanding transient responses. A low level understanding of electricity is facilitated by using water flow/pressure analogies. Using these tools, students can analyze simple circuits such as MOSFET common source amplifier and CMOS inverter.
 - b) In lab, students follow standard lab exercises, but do need to be able to interpret their measurements in terms of their understanding of operational principles.
 - c) It is unlikely that most students would be able to design a system, component, or process after completing EE100. However, they would know that such circuits can be designed, and understand their basic principles of operation.
 - d) By learning basic EE principles, engineers in other fields will be better able to communicate needs when working in multidisciplinary teams with EE's.
 - e) Students learn how to apply circuit analysis techniques such as KCL and KVL, as well as how to include dependent sources in circuits to model active components such as MOSFETs and op-amps.

- f) Ethics is briefly mentioned in terms of safety when working with electricity, and what dangerous voltage/current levels are. In terms of basic circuit analysis, there has not been much ethical connection made.
- g) The course does not require much communication. Questions on exams which ask students how to explain a very basic measurement technique have shown that students have a very difficult time expressing themselves.
 - In the course introduction and motivation, examples are given of electrical engineering field from the range of nanoelectronics (nanometer) to radio astronomy (light years) which may give students some idea of the breadth of fields one could apply EE techniques to.
 - As an introductory course, life-long learning is not emphasized.
- h) To motivate students, contemporary technological issues are used as examples at various points through the semester. Specific examples from Fall 2005 were MEMS and switching amplifiers. Students were presented with a contemporary switching amplifier schematic and shown how to understand the function of all the component circuits.
- i) In the lab students learn to use oscilloscope, function generator, power supply, and typical analog and digital components. Lab exercises also introduce students to schematic entry and Spice simulation tools.

5. **Prepared by:** Ronald Fearing (4/1/06)