Midterm #2, Coverage

Midterm Exam: Friday March 23, in class. The emphasis will be on material since the first midterm on frequency response, pn diodes and bipolar physics, and bipolar circuits. You may bring an additional sheet of hand written (not photocopied) notes for the new material. Bring your calculator. Paper provided.

Chapter 1 Introduction: Op-Amps may be used for frequency response.
Chapter 2 Semiconductor Physics and Process: All - Including mobility graph pp. 36.
Chapter 3 pn and MOS Electrostatics: All – light on derivation of the two-sided formulas.
Chapter 4 MOS Transistor: All – Light on 4.4.2 and none of the capacitance in 4.5.4-4.5.5.
Chapter 5 Logic: Only 5.3.1-5.3.2. Resistive load and a PMOS load circuit their analysis.
Chapter 6 The pn Junction Diode: 6.1-6.5, 6.9
Injection and extraction, law of the junction, minority diffusion current density from doping and dimensions, large signal model, transit time and depletion capacitance, small signal model, use of diode models in circuits, and diode applications.

Chapter 7 The Bipolar Junction Transistor: 7.1-7.5, 7.7-7.8
Injection and extraction, minority diffusion in the base, minority diffusion in the emitter, hole and electron fluxes, forward-active current gain, reverse-active operation, Ebers-Moll current model, modes of operation and I vs. V, small-signal model, Early effect, base-transit time and base-charging capacitance, depletion capacitances, parasitic resistance, lateral pnp and SPICE model.

Device Physics

- Flow of carriers through diodes and bipolar transistors.
- Basic physical equations for carrier concentration and minority diffusion.
- Relation of the saturation current and bipolar current gain to doping and dimensions.
- Transit time and contribution of stored charge to capacitance.

Device Circuits

- Use the large signal model to determine the operation mode of a bipolar device in a circuit.
- Use the large signal bipolar model to bias a transistor amplifier circuit.
- Find the small signal model parameters from the bias information.
- Find the gain or transconductance of a simple amplifier.

Chapter 8 Single Stage Amplifiers: Add 8.2 to 8.1 and 8.3. Common emitter amplifier, bias, small-signal equivalent circuit, element values and circuit gain.

Chapter 10 Frequency Response 10.1-10.3 LM notes on phasors

- Calculations with phasors such as impedance and power.
- Use loop and node equations to find the transfer function for a system.
- Make Bode magnitude and phase plots of a system response and label transition frequencies.