6.012 Microelectronic Devices and Circuits

Spring 2007

Tentative Schedule

Date	Lec/Rec#	Description	Reading
2/6	L1	6.012 Outline: grading, ethics, overview of semiconductor applications; silicon IC technology	2.5
2/8	L2	Intrinsic semiconductors, electrons and holes, bond model, generation recombination and thermal equilibrium; doping, donors, acceptors, compensation	2.1-2.2
2/13	L3	Carrier transport; drift velocity, drift current density, diffusion current density	2.4
2/15	L4	The p-n junction; carrier concentration and potential in thermal equilibrium, 60mV rule	3.2-3.3
2/22	L5	The p-n junction in thermal equilibrium	3.4
2/27	L6	Introduction to the MOS structure, MOS capacitor in thermal equilibrium	3.7
3/1	L7	MOS capacitor under applied bias, accumulation, depletion, and inversion regions	3.8
3/5	L8	MOSFET physical structure, circuit symbol and terminal	4.1-4.3

		characteristics, MOS transistor characteristics	
3/7	L9	MOS transistor; backgate effect, MOSFET in saturation	4.4
3/13	L10	MOSFET small-signal model	4.5
3/15	L11	Digital logic concepts, inverter characteristics, logic levels and noise margins, transient characteristics, inverter circuits, NMOS/resistor loads	5.1-5.2
3/20	L12	NMOS/current source load, CMOS inverter, static analysis	5.3-5.4
3/22	L13	CMOS inverter, propagation delay model, static CMOS gates	5.5
4/3	L14	p-n junction diode terminal characteristics, minority carrier concentration under forward + reverse bias	6.1-6.3
4/5	L15	Short base approximation, steady state diffusion equation with currents in p-n junction	6.3
4/10	L16	p-n junction diode circuit model, large signal static model, small signal model, diffusion capacitance	6.4
4/12	L17	Introduction of bipolar junction transistor, terminal characteristics, forward active bias, current gain	7.1-7.2

4/19	L18	Reverse active mode and Saturation, The Ebers-Moll model	7.3-7.4
4/24	L19	Single stage amplifiers, two port small signal model; common source amplifier with resistor and current source supply	8.1-8.6
4/26	L20	Common base/gate amplifier, common collector/drain	8.8-8.9
5/1	L21	Review frequency domain analysis; current gain frequency response of common emitter amplifier	10.1-10.3
5/3	L22	Voltage gain frequency response of common emitter amplifier, full analysis of common emitter, the Miller approximation	10.4
5/8	L23	Open circuit time constant analysis, CG and CD	10.5-10.6
5/10	L24	Multistage amplifiers, cascading small signal two port models	9.1-9.2
5/15	L25	DC coupling, voltage sources, MOS current sources, current sources and sinks	9.4
5/17	L26	Analyzing complex circuits; Wrap-up	9.6, 10.7