Syllabus – EE482, Autumn 2002

Topics	Reading	Hours
Introduction • outline, objectives		1
Physics of Semiconductor Materials in Equilibrium • basic quantum mechanics • band theory • Fermi-Dirac and Maxwell-Boltzmann statistics • free carrier concentrations and the Fermi level • donors and acceptors	1.1-1.4, 2.1-2.5, 3.1-3.5 4.1-4.7	6
Movement of Free Carriers in Crystals • thermal motion • drift (response to electric fields) • diffusion (response to concentration gradients)	5.1-5.5	2
Physics of Semiconductors under Nonequilibrium • generation and recombination • injection and extraction • quasi-Fermi levels • device equations • light generated carriers	6.1-6.7 14.3.1	6
Midterm 1 — Friday, October 25 (tentative)		
PN Junctions • band diagrams • I-V characteristics • capacitance • carrier distributions • AC/switching characteristics and modeling • breakdown mechanisms • interactions of light with PN junction • heterojunctions	7.1-7.5, 8.1-8.7, 9.3, 14.2.1, 14.3.2-14.3.3, 14.5	6
Metal-Semiconductor Contacts • band diagrams • I-V characteristics • Schottky diodes, ohmic contacts	9.1-9.2	3

Topics	Reading	Hours
MOS Capacitors • C-V characteristics • oxide charges • C-V measurements	11.1-11.2	3
MOS Transistors • principles of operation • I-V characteristics	11.3-11.6, 11.1-11.5	5
Midterm 2 — Friday, November 22 (tentative)		
• device parameters and models • threshold voltage control • subthreshold conduction • switching speed		
Bipolar Transistors • principles of operation • current gain • I-V characteristics • Ebers-Moll model • Early effect (base width modulation) • β roll-off at low, high currents • base resistance • frequency limitations and AC response • charge-control model • breakdown	9.1-9.9	5