Syllabus – EE482, Winter 2011

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, ASF 1-4	6
Movement of Free Carriers in Crystals • thermal motion • drift (response to electric fields) • diffusion (response to concentration gradients)	1.2-1.3, ASF 6	2
Physics of Semiconductors under Nonequilibrium • generation and recombination • injection and extraction • quasi-Fermi levels • device equations • light generated carriers	5.1-5.2, ASF 5	6
Midterm 1		
Metal-Semiconductor Contacts • band diagrams • I-V characteristics • Schottky diodes, ohmic contacts	3	3
PN Junctions • band diagrams • I-V characteristics • capacitance • carrier distributions • AC/switching characteristics and modeling • breakdown mechanisms • interactions of light with PN junction • heterojunctions	4,5	6

Topics	Reading	Hours
MOS Capacitors • C-V characteristics • oxide charges • C-V measurements	8	3
Midterm 2		
MOS Transistors • principles of operation • I-V characteristics • device parameters and models • threshold voltage control • subthreshold conduction • switching speed	9,10	5
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	6,7	5