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| COURSE: EECS 421. TITLE: Properties of Transistors. PREREQUISITES: EECS 320 or Graduate standing. | | ELECTIVE. |
| TEXTBOOK: Muller, Kamins, Chan, <i>Device Electronics for Integrated Circuits</i> , 3rd ed., Wiley | | |
| CATALOG DESCRIPTION: DC, small and large signal AC, switching and power-limiting characteristics, and derivation of equivalent circuit models of: PN junctions, metal-semiconductor and metal-insulator semiconductor diodes, bipolar junction transistors, junction and insulated-gate field-effect transistors, and thyristors. | | |
| COURSE OBJECTIVES: 1. To teach students how to analyze operation of semiconductor devices from a fundamentals viewpoint; 2. To derive the Shockley-Read-Hall recombination theory from first principles; 3. To teach students how to build small-signal models for diodes and transistors; 4. To teach students tradeoffs (gain-bandwidth-breakdown) in designing bipolar junction transistors; 5. To teach students MOSFET operation: basic physics; bulk charge; diffusion current (Pao-Sah model). | | TOPICS COVERED: 1. Semiconductor physics review 2. Quasi-Fermi level concept 3. Metal-semiconductor diodes 4. p-n junction diodes 5. Current-limiting mechanisms 6. Intermediate-level theory of bipolar junction transistors 7. Insulated-gate FETs |
| COURSE OUTCOMES [Program Outcomes Addressed] 1. Ability to identify current-limiting mechanisms (thermionic emission, depletion-region drift-diffusion, bulk diffusion) for a metal-conductor or p-n diode & work function & minority current lifetime; [1,11] 2. Ability to estimate DC gain, parasitic capacitances & resistances, unity-current-gain frequency, VCB0 for a bipolar junction transistor and its related parameters; [1,11] 3. Ability to estimate threshold voltage, transconductance, iv characteristic for a long-channel mosfet;["] 4. Ability to compute capture, emission & minority carrier lifetime for a given semiconductor trap [1,11] | | ASSESSMENT (Course outcomes) 1. Weekly problem sets [1,2,3,4] 2. Midterm and final open-book exams [1-4] |
| PROGRAM OUTCOMES ADDRESSED: 1,11 PROFESSIONAL COMPONENT ADDRESSED: 13 PREPARED BY: Andrew E. Yagle on Nov. 25, 2004 | CLASS/LABORATORY SCHEDULE: LECTURES: 2 per week @ 90 minutes. | |

COURSE DESCRIPTION: University of Michigan, College of Engineering, ELECTRICAL ENGINEERING PROGRAM