ELEC 2210 – DIGITAL ELECTRONICS

2009 Catalog Data: ELEC 2210. DIGITAL ELECTRONICS (4) LEC. 3, LAB 3. Pr., ELEC 2110, ELEC 2200. History of electronics; semiconductors; biasing and operation of PN junction diodes; field-effect transistors and bipolar junction transistors; logic families and logic technologies; flip-flops and memory circuitry


Coordinator: B. M. Wilamowski, Professor of Electrical and Computer Engineering.

Course Objectives:
1. To understand electrical conduction in solid state materials
2. To be able to analyze circuits containing diodes
3. To be able to analyze and design dc and switching circuits containing transistors
4. To be able to analyze and design bipolar and MOS combinational logic circuits at the transistor level

Prerequisites by topic:
1. Introductory computer programming in a high level language
2. Electric circuits (prerequisite)
3. Logic design (corequisite)

Lecture Topics:
Class Schedule (50 minute classes):
1. History of electronics
2. Introductory semiconductor physics
3. Diode current-voltage characteristics, Zener breakdown, biasing, load lines
4. Diode applications, half-wave and full-wave rectification, Zener regulation
5. Field-effect transistor (FET) characteristics and operating regions
6. Biasing of FETs
7. Characteristics of digital signals
8. The FET as a switch, the NMOS logic family
9. The CMOS-logic family
10. Memory circuits and sense amplifiers
11. Bipolar junction transistor (BJT) characteristics, Transport Model equations
12. Biasing of BJTs
13. The BJT as a saturated switch
14. Transistor-transistor logic (TTL)
15. SPICE device models and circuit simulation
16. Homework solutions
17. Tests and review

Lab Topics:
1. Equipment intro, safety review, basic digital logic circuits
2. Switch de-bouncing
3. Simulation of logic circuits
4. Medium Scale Integration (MSI) logic circuits
5. Binary arithmetic circuits
6. Finite state machine design  
7. Diodes, LED’s, and light sensors  
8. Field effect transistor characteristics and biasing – week 1  
9. Field effect transistor characteristics and biasing – week 2  
10. Bipolar junction transistor characteristics and biasing – week 1  
11. Bipolar junction transistor characteristics and biasing – week 2  
12. Discrete CMOS logic  
13. Two-week design project – IR remote control interface – week 1  
14. Two-week design project – IR remote control interface – week 2

Typical method for evaluating student performance:  
  Homework          10%  
  Laboratory         10%  
  Exams (3)          60%  
  Final exam         20%

Homework: Problems from the textbook and other sources will be assigned throughout the semester to reinforce the class material. Some problem assignments will require the use of a circuit simulator such as PSPICE. Some problems will require the student to program in a high-level language, spreadsheet, or MATLAB. Homework problems will be graded and returned to the student as quickly as possible.

Class attendance: Class attendance is encouraged, but will not be accounted for in the course grade.

Policy on unannounced quizzes: Unannounced quizzes may be given at any class meeting to encourage students to attend class and to keep up with the class reading.

Special Accommodations: It is the policy of Auburn University to provide accessibility to its programs and activities, and reasonable accommodation for persons defined as having a disability under Section 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990. Students who need special accommodations should make an appointment to see the instructor as soon as possible or contact the Students with Disabilities Office at (334) 844-5943 (Voice/TT).

Contribution of course to meeting the professional component  
  Engineering topics: 3 credits 67% engineering science (2 credits) 33% engineering design (1 credit)

Primary program outcomes related to this course:  
  Outcome 1. Ability to apply knowledge of math, science and engineering to solve problems.  
  Outcome 3. Ability to design an electrical component or system to meet desired needs.  
  Outcome 6. Proficiency in the use of computers and other modern tools to solve engineering problems.

Prepared by:  T. A. Roppel  Date: February 4, 2008