

## EE 251 DIGITAL ELECTRONICS

Spring 2015  
3 Lecture Credit Hours

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- Instructor:** Dr. Xian-An Cao, Associate Professor  
729 Engineering Sciences Building  
Phone: 293-9684; Email: xacao@mix.wvu.edu
- Office Hours:** M/W/F 1:00-2:00 pm, or by appointment. If my door is open at other times, feel free to step by and ask questions.
- Class Time:** MWF 12:00 -12:50 Class Location: G83 ESB
- Prerequisites:** EE 221 and EE 222, and CpE 271 and PHYS 112.
- Co-requisite:** Digital Electronics Laboratory (EE 252). If you drop EE 251 you must also drop EE252.
- Required Text:** Microelectronics Circuit Analysis and Design. 4<sup>th</sup> Ed. By Donald C. Neamen. McGraw-Hill Higher Education. ISBN 978-0-07-338064-3. This text will also be used in EE 355.
- Course website:** <http://www.csee.wvu.edu/classes/ee251> (old course website - you may still find some useful info and links there)  
  
eCampus > Course Content – Homework/project assignments and homework/test solutions will be posted on the web page. Time critical information will be sent to your MIX e-mail.
- References:** TTL and CMOS Data Books available from Texas Instruments and National Semiconductor. Data sheets are also available at:
1. [Fairchild Semiconductor](http://www.fairchildsemi.com) www.fairchildsemi.com
  2. [National Semiconductor](http://www.national.com) www.national.com
  3. [Texas Instruments](http://www.ti.com) www.ti.com
- Recommended Software:** PSPICE, Excel Spreadsheet, and MATLAB or MATHCAD. You may be required to submit assignments using PSPICE.
- Learning Outcomes:** After successfully completing this course, you should be able to
- Understand basic solid state physics concepts as they apply to metals, semiconductor materials, p-n junctions, and bipolar and field effect transistors.
  - Calculate the output and voltage transfer of diode and transistor circuits using appropriate circuit models.
  - Determine expected performance of digital circuits or devices using PSPICE.
  - Determine device performance from data sheets and use information to design circuits to meet certain performance requirements.
  - Analyze RTL, ECL, TTL, CMOS, and Bi-CMOS digital gates to determine terminal specifications.
  - Describe operation of complex transistor circuits such as Memory Cells, Data converters.

## Tentative Lecture Topics:

<u>Subject</u>	<u>Chapter</u>
Introduction	
Semiconductor Materials, Doping, and Conductivity	1
PN Junctions, V-I Characteristic, Diodes	1
Diode Circuits, Zener Diode, LEDs	2
<b>Exam #1</b>	
BJTs, CE Characteristics, Switches	5
ECL, TTL, Schottky TTL Logic Design and Applications	17
<b>Exam #2</b>	
MOSFETs, CS Characteristics, Switches	3
NMOS and CMOS Logic Circuits, Memory, and Bi-CMOS	16
<b>Final Exam</b>	

## Grading:

Homework	10%
PSpice projects	10%
Exam 1&2	46% (2 at 23% each)
Final Exam	34%

There will be approximately 7 homework assignments and 2 PSpice projects given throughout the semester. Homework is due at the **beginning** of class on the assigned date. Most homework problems will be assigned from the text. You are encouraged to discuss the homework problems with other students in the class; however, the discussion must end when you write your solutions. Thus, the work on the paper must be your work. Each set of homework and project report will be given a letter grade. Late homework and report will not be graded and will not count. Course grades will be assigned on a standard scale: be 90-100% =A, 80-89% =B, 70-79% =C, etc.

## **Attendance:**

Attendance is strongly encouraged. Attendance may be recorded at random times throughout the semester. All students are responsible for the material covered in class even if it is not in the textbook, and for the material posted on the course webpage. It is your responsibility to make sure that all assignments are turned in on time and that you are aware of all announcements made in class. Please arrive to class on time. Consistent with WVU guidelines, students absent from scheduled examinations because of authorized university activities will have the opportunity to take them at an alternate time. Make-up exams for absences due to any other reason will not be given unless you have absence approved before the exams.

**Academic Integrity:** The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of WVU regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at [http://campuslife.wvu.edu/office\\_of\\_student\\_conduct](http://campuslife.wvu.edu/office_of_student_conduct). Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

## **Social Justice Statement:**

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see [diversity.wvu.edu](http://diversity.wvu.edu).