

WEST VIRGINIA UNIVERSITY

Lane Department of Computer Science & Electrical Engineering

Course: **EE 251 Digital Electronics**

Semester: Spring 2020

Course Format: Lecture (3 credit hours)

Instructor: Dr. Jeremy Dawson
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Office Hours: T, Th 9:30-10:30AM, or by appointment

Time: MWF, 12:00-12:50 PM

Text: Microelectronics Circuit Analysis and Design, 4th Ed. By Donald C. Nemeian. McGraw Hill Higher Education ISBN: 978-0-07-338064-3 (text also used in EE 355)

Co-requisite: Digital Electronics Laboratory (EE 252)

Prerequisites: EE 221, EE 222, CpE 271, and PHYS 112

Recommended Software: OrCAD PSICE or equivalent, Excel, MATLAB or MATHCAD. You may be required to submit assignments using OrCAD PSPICE or equivalent

Course Objectives: The objective of this course is to present basic principles needed to understand the design and operation of digital electronic circuits comprised of solid state pn-junction and transistor technologies, including: switches, logic gates, and amplifiers.

Expected Learning Outcomes:

In order to successfully complete this course, you must demonstrate that you have achieved the following

- 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 voltage and voltage transfer characteristics of diode and transistor circuits using appropriate circuit models
- Determine expected performance of digital circuits or devices using LTSPICE
- Determine device performance from data sheets and use information to design circuits to meet certain performance requirements
- Analyze RTL, TTL, CMOS, and Bi-CMOS digital gates to determine terminal specifications
- Describe the operation of complex transistor circuits such as A/D and D/A converters

Tentative Topical Outline:

| <i>Topic:</i> | <i>Chapter</i> |
|---|----------------|
| Introduction | |
| Semiconductor materials, doping, and conductivity | 1 |
| PN junctions, I-V characteristics, diodes | 1 |
| Diode circuits, Zener Diode, LEDs | 2 |
| EXAM 1 | |
| MOSFETs, CS characteristic, switches | 3 |
| NMOS and CMOS logic circuits, RAM and ROM | 16 |
| EXAM 2 | |
| BJTs, CE characteristics, switches | 5 |
| Review | |
| FINAL EXAM | |

Grading:

Semester grades will be roughly computed as follows:

| | |
|--|----------|
| Homework (4) | 6% |
| Quizzes (11, two lowest will be dropped) | 11% |
| PSPICE Assignment | 9% |
| Exams (2) | 37% each |
| Final Exam (optional*) | 37% |

**only the two highest exam grades will be counted toward final grade; final is cumulative*

Exams will seek to determine students' level of mastery of fundamental principles and methods developed in lectures and text, reinforced and expanded upon through homework and project assignments. Letter grades will be determined on a 10-point scale (90-100%=A, 80-89%=B, etc). Grades assigned during the semester on exams, quizzes, reports, or homework assignments are considered final and are not subject to negotiation for any reason other than an obvious mistake in grading. Tests will occur approximately during weeks 5-6 and 11-12 (actual dates will be chosen during class). The final exam will occur during the University-determined time slot.

Homework Format: Homework must be completed on either plain white paper or engineering paper, one sided only. Assignments submitted on loose-leaf or torn-out spiral bound notebook pages will **not** be accepted. Students are strongly encouraged to use pencil, and to include all calculation steps, with clear, legible handwriting. Each page should contain **no more than two** problem solutions (including parts (a), (b), etc.). Final answers must be **clearly indicated** by a circle or a box.

Attendance and Late Assignments:

Students are expected to make every effort to attend class and *arrive on time*. Make-up exams and quizzes will **only** be offered if prior arrangements are made with the instructor so that you can take them prior to the date they are given in class. Unexcused late homework assignments and reports will lose *10 points per day starting at the beginning of the lecture due*. Assignments handed in after homework is collected at the beginning of class, even during the same lecture, will be considered **late**.

Adverse Weather Commitment

In the event of inclement or threatening weather, everyone should use his or her best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact me as soon as possible. Similarly, if I am unable to reach our class location, I will notify you of any cancellation or change as soon as possible (by 6:30am), using the email address you provide to prevent you from embarking on any unnecessary travel. If you cannot get to class because of weather conditions, I will make allowances relative to required attendance policies, as well as any scheduled tests, quizzes, or other assessments

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. Students in the Lane Department of Computer Science and Electrical Engineering are expected to behave ***ethically*** and ***professionally***. A statement to this effect will be included as a reminder on all examinations and is implicit when the student places his or her signature on tests and homework assignments. In addition to the WVU policies on cheating in the WVU student Handbook, the Lane Department and your instructor add the following:

In particular, academic dishonesty, including plagiarism and cheating, *will not be tolerated*. If a student submits any assignment (report, project, homework, portfolio, exam, etc.) under his or her name that has been reproduced in any part or in whole from the work (paper or electronic) of others without specifically citing the source, they are being academically dishonest. They are also being dishonest if they knowingly allow their work to be submitted by someone else without acknowledgement that it is theirs.

The major provisions of the Statler College policies for enforcing academic integrity follow:

- Use of cell phones, smart wearable devices, or possession of other external communication devices are strictly prohibited during exams, tests, or quizzes administered inside the classroom. Departments may specify acceptable calculators and additional restrictions.
- Common standards of academic integrity prohibit not only cheating or plagiarizing, but also the unethical conduct of trying to obtain grades that the student has not earned. Violations of academic integrity are described in the WVU Catalog: <http://bit.ly/2hDAeUa>.
- Students have the right to appeal final grades that do not involve charges of academic dishonesty. Students may appeal charges of academic dishonesty. The appeal process is outlined in the WVU Catalog: <http://bit.ly/2uiMM9E>.
- Incidents of student misconduct or academic dishonesty will be handled promptly and appropriately in accordance with the WVU Student Conduct Code and Discipline Procedure. The case will be referred to the Office of Student Conduct. *Violations may lead to dismissal from the Statler College and expulsion from the University.*

Social Justice Statement:

West Virginia is committed to social justice. The instructor concurs with that commitment and expects to maintain a positive learning environment based upon open communication, mutual respect, and nondiscrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color, or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise the instructor and make appropriate arrangements with Disability Services (293-6700).

Religious Observances:

WVU recognizes the diversity of its students, some of whom must be absent from class to participate in religious observances. You must, however, notify the instructor in writing by the end of the third class meeting regarding religious observances that will affect your attendance. Reasonable accommodations will be made for tests or quizzes that you will miss, providing there is at least one week's notice.