ECE 331: Electronic Principles I

Brief Course Description: This course is designed as single semester, junior level, undergraduate course in the Department of Electrical and ComputerEngineering at Colorado State University. Theaim of this course is toprovide undergraduate students with detailed understanding of diodes, MOSFETs and BJTs and theirapplication in single-transistor circuits.

Prerequisites: ECE 202, MATH 340/345, PH 142

Course Credits: 4
Class Lecture Sessions: 3:00 – 4:15, Monday and Wednesday.
Classroom Location: Clark Building,A206
Instructor: Sourajeet Roy
Office: Engr. Bldg. C103J
Email: sjeetroy@engr.colostate.edu
Phone: 491-0595
Office Hours: Thursday12:30 to 2:30 PM
These hours may be adjusted based on student feedback. If students have scheduledcourse conflicts with these times, they may request in advance an appointment at anothertime. Please plan ahead on homework to use available office hours.

Textbook:B. Razavi, *Fundamentals of Microelectronics: 2nd Ed.*John Wiley 2007 or 2014

Webpage: This course will use CSU's RamCT (http://ramct.colostate.edu), and theECE331 course webpage in RamCT is only accessible to registered students. To reachRamCT, direct your browser to http://ramct.colostate.edu and log in using your eID. Ifyou are unable to log into RamCT, contact the ACNS helpdesk for support. If you havebeen registered for the class for more than about 48 hours you should see a link for"2014FA-ECE-331-001: Electronics Principles I" listed on the screen.

Course Objectives

It is myexpectation that after taking this course,students will have gained the following skills.

1. Qualitatively describe the basic semiconductor physics of these devices
2. Name the operating regimes for each device and determine the appropriatealgebraic formula for the current-voltage terminal characteristics in that regime.
3. Plot the combined current-voltage characteristics of the regimes for each and use similar graphs to determine critical parameters for the devices.
4. Reproduce equivalent circuits for each device.
5. Apply the algebraic formulas, equivalent circuit models and graphicalrepresentations of current-voltage characteristics to solve for the terminal currentsand voltages of the devices in simple circuits.
6. Describe the most important deviations from the ideal models observed in actualdevices.
7. Describe the difference between large signal, small signal and bias point analysisand the associated assumptions.
8. Name the three basic single-transistor amplifier configurations and choose thebest one for various applications
9. Design circuits for biasing a transistor in each of the three basic amplifierconfigurations.
10. Describe how to use transistors in switching applications and as current sources.

11. Design rectifier circuits including selecting capacitor values to meet ripplespecifications.
12. Draw basic current mirror circuits and describe their purpose and function.
13. Build diode and single-transistor circuits and measure their operation usinglaboratory bench instruments.
14. Analyze simple circuits containing diodes or transistors using analytical methods.
15. Analyze circuits containing diodes and transistors using electronic designsoftware.
16. Write laboratory reports that effectively communicate the student's design,analysis and characterization of simple diode or transistor circuits

Course Topics: The planned course topics are:

• Introduction to semiconductors and operation of pn junctions (Chapter 2): 1.5 weeks
• Diodes models, large/small signal operation model, diode circuits and their applications (Chapter 3): 1 week
• Bipolar junction transistors (BJTs): Physics of BJTs, large/small signal model, BJT biasing and amplifier topologies (Chapter 4, 5): 2.5 weeks
• Metal-oxide field effect transistors (MOSFETs):Physics of MOSFETs, large/small signal model, MOSFET biasing and amplifier topologies (Chapter 6, 7): 5 weeks
• Op-amps, exams, review, open 4 weeks

Grading: Your overall score will be based on the following weighting:

Labwork	15%
Midterm	25%
Homework Assignments	20%
Final Exam	40%

The course TA will provide details on laboratory assignments and grading. Students whopreviously took this course the immediately preceding year may elect to receive the samelaboratory component score rather than repeating the lab section of the course.

The midterm exams will be held in class and are tentatively scheduled for October 8th. All exams are closed book, but you are allowed to bring one sheet of notes (frontand back) to the midterm exam, and threesheets of notes to the final exam.

All class notes, power point presentations, demons/videos etc. will all be uploaded onto RamCT.Homework is typically due a week from the date of uploading. All homework will be uploaded via RamCT or handed out in class. A total of 8 sets of homework assignments is required for this course. All homework assignments will be corrected and handed back with a 2 weeks from submission. There will be 2 review classes before the midterm and four before the final exam.

Grades will be assigned according to the following scale:

> 97% A+	77-80% C+	< 63% F
93-97% A	73-77% C	
90-93% A-	63-73% D	
87-90% B+		
83-87% B		
80-83% B-		

Thegrading scale may be adjusted to award higher grades at the instructors' option.

Proper crediting of academic sources and plagiarism: I take properly creditingsources of information seriously. I do not expect or anticipate that you will be able tocomplete all the assignments for class without outside help. In fact, part of learningshould be locating and using additional sources of information independently of yourinstructor. I encourage you to discuss the homework with fellow students, and availyourself of any other sources of information you wish. However, you must properlycredit in each and every homework problem the sources of information you useincluding discussions with classmates or other individuals, articles, books, webpages,solutions manuals or any other information source; however, you do not need to citelectures, lecture notes, or the textbook as it is assumed you will be using these. Do notsimply write the names of your study group once for the assignment, but credit theactual individuals that help you on each individual problem. You must credit thesource if you use its ideas whether or not you reproduce it verbatim. If you exactlyreproduce more than a phrase or single equation verbatim, you must enclose the itemin quotation marks and properly credit it. You are not allowed to exactly reproduceanother current student's work. Duplicate homework or other assignments willbe substantially penalized and typically receive zero points. If you fail to credit yoursources on homework, you will be penalized on the assignment and repeated offensesmay incur harsher consequences up to and including failing the class. See penalties andprocedures for dealing with plagiarism as outlined in the General Catalog. Unfortunately,I have had to reduce the final letter grades of students in upper level classes in the pastdue to plagiarism, and I have the prerogative to fail students for such offenses