ECE 430 Principles of Semiconductor Devices FALL 2012

Class Time and Location:  Sec. 001 - 74000 MW 12:00 p.m. – 1:15 p.m.  Room# Eng. Bld. 3511

Instructor:  Alok K. Berry, Room No. 3238 in Nguyen Engineering Building  
TA: Phone: (703)-993-1606  
Office Hours: TW 2:00 p.m. – 3:30 p.m.  
email: aberry@gmu.edu  
Others by appointment

0201543931, Cost-New Book $196.80, Used Book $147.60.

Prereq:  Math 214, ECE 305 and a grade of C or better in ECE 333; or permission of instructor

Topics:  Introduces solid-state physics and its application to semiconductors and semiconductor devices.  
Topics include band theory, doping, p-n junctions, diffusion theory, low-frequency circuits, and devices including bipolar transistor, MOSFET, CMOS, and photo transistors.

Important Instructions/Information

a.  Prior to the class, it is expected that one reads the material which is to be covered in the class.

b.  Almost in every class a set of assigned homework problems will be collected, graded and then it will be returned.  Home works will be accepted in class only and after grading returned in class.  If you happen to miss a class when HW is returned, it is your responsibility to collect it promptly.

c.  Some homework solutions may be provided.  Solutions to exams will be discussed in class.

d.  No overdue for homework and no make up for exams.  
   In an extreme case if a makeup exam is given only 50% of the credit (what one earns in the makeup exam) may be counted in making the final grade.  The makeup exam may be an oral exam.

e.  GMU HONOR CODE will be strictly enforced. Violations of the honor code may result in receiving no credit for this course.  Any work submitted by you, which is to be graded, must be of your own. If it is found that the work submitted by a student has been copied from solution manual or from some other source then the case may be forwarded to the Honor Committee.

f.  Important Dates:  
The final drop deadline is Monday, September 28th.  
The Selective Withdrawal Period is from October 1st to October 26th.

Grading:  
Home Works and Class Participation  20%  
Project/Presentation/Poster  10%  
1st Class Exams  35%  
Comprehensive Final Exam  35%  
Comp Final Exam  Monday, December 17th, 2012  
Time 10:30 a.m. – 1:15 p.m.  
If no project is given then each exam will be worth 40%.

Topics to be Covered
1. Semiconductor Fundamentals 4.5 weeks
2. The pn Junction Diodes 5 weeks
3. Field Effect Devices 3 weeks
4. If time permits some material from Part IIB from the book will be covered.

Two Exams 1 week/2 Classes

**Please follow the following guidelines for ECE 433 homework**

1. Use **only** the regular size paper (8.5" by 11")
2. All pages **must** be stapled.
3. Do the homework neatly and show all the steps clearly.
4. **Must draw** the required diagram/diagrams for each problem? No grades for the entire homework if in any problem required diagrams are not drawn.
5. Put the answers in **block** or **underline** them. You will lose 50% of the grades in any HW if you do not highlight the answer/answers.

The homework **will not be accepted** if these guidelines are not followed.

**IMPORTANT:** Please note it is the university policy that all sound emitting devices (cell phones, pagers etc.) shall be turned off during classes unless otherwise authorized by the instructor. It is required by me that all of these devices will be kept in the purse or in the back-pack. If you have an emergency please talk with me prior to the class.

**VERY IMPORTANT:** If you receive very low grades in one or more class exams then you may receive a grade of “D” or “F” in the course.

**Extremely Important:** Your final grade is assigned based upon what you have earned during the semester. This is a demanding course and make sure that you spend enough time to understand the material and demonstrate it in exams and during class discussions.

The homework will be accepted only during the class. Graded homework will be returned in the class. The graded work of the students not present in the class will be placed in a box in my office. If you are not present in the class, it is your responsibility to collect it.

You are allowed to discuss the home works and projects with your classmates but copying any material to be submitted for grading will be considered a violation of the honor code.

**In exams you are not allowed to bring any formula sheet, if necessary I will provide the formulas.**

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**Tentative Class Schedule**

<table>
<thead>
<tr>
<th>Class/Classes</th>
<th>Subject</th>
<th>Lecture Reference</th>
<th>Independent Reading</th>
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1 and 2  Semiconductors, General Introduction  1.1 – 1.4  Section 1.3
3, 4, 5  Semiconductor Models, Carrier Properties  2.1 - 2.3  Appendix A-1, A3.2
State and Carrier Distributions  2.4
Equilibrium Carrier Concentrations  2.5  2.6
6 and 7  Drift and diffusion  3.1 – 3.3
Recombination-generation, Eq. of state etc.  3.3 – 3.5  3.6
8 and 9  Oxidation, Diffusion, Ion-implantation  4.1
Lithography, Thin Film Deposition and  4.1 – 4.2  4.3
Device Fabrication
10 and 11  pn Junction Electrostatics  5.1 – 5.3  5.3
12 and 13  Diode I – V Characteristics  6-1 – 6.3  6.4
14 (10/15)  Ist Class exam  Chapters 1 - 6
15 and 16  Reverse Bias Junction Capacitance  7.1 – 7.2
Forward Bias Diffusion Admittance  7.3  7.4
17 and 18  Diode Transient Response  8.1 – 8.2  8.3
19 and 20  Photodiodes, Solar Cells and  9.1 – 9.3
LEDs
21 and 22  J-FET and MESFET  15.1 – 15.3  15.4
23, 24 and 25  MOS Fundamentals  16.1 – 16.4  16.5
26 and 27  MOS Operation  17.1 – 17.3  17.4
28  Schottky Diode  14.2
12/17  Comp Final Exam  Chapters 1 – 9, 14.2, 15 - 17 (More will be discussed in class)
GOOD LUCK AND ENJOY THE COURSE/PROJECT
ACADEMIC INTEGRITY

GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else’s work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

GMU EMAIL ACCOUNTS
Students must use their Mason email accounts - either the existing “MEMO” system or a new “MASONLIVE” account to receive important university information, including messages related to the class. See http://masonlive.gmu.edu for more information

OFFICE OF DISABILITY SERVICES
If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu

OTHER USEFUL CAMPUS RESOURCES:
WRITING CENTER: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu
UNIVERSITY LIBRARIES “Ask a Librarian”
http://library.gmu.edu/mudge/IM/IMRef.html

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): (703) 993-2380;
http://caps.gmu.edu

UNIVERSITY POLICIES
The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/.

In case of emergency the important number to call is (703)-993-2810