

ECE 371 - MATERIALS AND DEVICES

Semester: Fall 2014

Class Time: M-W 9:30am-10:45am

Class Location: GSM-232

Instructor:

Professor Daniel Feezell

Electrical & Computer Engineering Department

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Office Location: CHTM Room 112B

Office Hours: After class in ECE building or by appointment

Teaching Assistants:

Mr. Rhett Eller

Electrical & Computer Engineering Department

E-mail: reller2@unm.edu

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Office Hours: Tu 11am - 12pm, W 1pm - 2pm

Ms. Farhana Anwar

Electrical & Computer Engineering Department

E-mail: fanwar@unm.edu

Office Location: CHTM Room 109 (Cubicle #2)

Office Hours: Thursday (3-5 PM)

Class Website:

<http://www.unm.edu/~dfeezell/ECE371/>

I will post the syllabus, homework assignments and solutions, lecture slides, and other course materials. The website requires you to login using your UNM NetID. A detailed course schedule is also available on the course website. This schedule includes the material to be covered, recommended sections of the book for reading, exam dates, and HW assignments and due dates. Please note that the schedule is approximate.

Topics Covered:

Semiconductor materials (Ch. 1) - crystal structures, unit cells, miller indices, bonding, imperfections, and growth. Quantum mechanics (Ch. 2) – the uncertainty principle, Schrodinger equation, wave functions, electrons in free space, infinite potential wells, step potential functions, and tunneling. Quantum theory of solids (Ch. 3) – energy bands, Kronig-Penney model, dispersion curves, effective mass, holes, density of states, and Fermi-Dirac distribution. Semiconductors in equilibrium (Ch. 4) – equilibrium carrier concentrations, Fermi-level position, dopant atoms, III-V semiconductors, extrinsic semiconductors, and charge neutrality. Carrier transport (Ch. 5) – drift current, mobility, conductivity, diffusion current, and Einstein relation. PN junctions (Ch. 7) – built-in potential, electric field, space charge width, reverse bias, and breakdown. PN junction diodes (Ch. 8) – charge flow, current-voltage relation,

minority carrier distribution, and ideal diode equation. MOSFETs (Ch. 10) – MOSFET structures, energy band diagrams, surface charge density, flat band voltage, threshold voltage, basic MOSFET operation.

Required Text:

“Semiconductor Physics and Devices: Basic Principles,” D. A. Neamen, McGraw Hill, 4th edition (2012), ISBN: 978-0-07-352958-5.

Reference Text:

“Solid State Electronic Devices,” B.G. Streetman and S. Banerjee, Prentice Hall, 5th edition (2000), ISBN: 0-13-025538-6

Prerequisite or Concurrent Enrollment:

Phyc 262

Grading:

Homework (assigned approximately every other week on Mondays)	30%
Midterm Exam 1 (Wednesday 9/17, 9:30am-10:45am, covers ch. 1-2)	20%
Midterm Exam 2 (Wednesday 10/22, 9:30am-10:45am, covers ch. 3-5)	20%
Final Exam (Monday 12/8, (9:00am-12:00pm, cumulative but focused on ch. 7,8,10)	30%

Homework Policy:

Late homework assignments will typically not be accepted as I will post the solutions to the assignments right after you turn them in. Homework is due at the *beginning* of the class period on the due date. Homework should be neatly written, with each problem labeled and the pages stapled together. *Show your work in order to get maximum credit!* If the problem says “plot” you should use Excel or Matlab, if the problem says draw or sketch, you can do it by hand.

i>clickers:

This course will occasionally use i>clickers to create a more interactive learning environment. i>clickers can be purchased at a reduced price at the bookstore. For more information see:

<http://www1.iclicker.com/student-remote-iclicker-plus>

<http://www.unm.edu/~oset/teachingwithclickers.html>