ECE 416/516 IC Technologies Syllabus and Schedule (Spring 2012)

Week	Monday Lecture	Wednesday Lecture
4/02-4/04	1. Introduction (Ch1)	2. Substrates (Ch 2)
4/09-4/11	3. Diffusion (Ch 3)	4. Oxidation (Ch 4) SR I
4/16-4/18	5. Implantation (Ch 5) Assign #1 Ch 1, 2, 3 due	6. Rapid Thermal Processing (Ch 6) SR
4/23-4/25	7. Optical Lithography (Ch 7) Assign #2 Ch 4, 5 due	8. Photoresist (Ch 8) SR
4/30–5/02	9. Non-optical Litho (Ch 9) Assign #3 Ch 6, 7 due	10. Vacuum/plasma (Ch 10) SR
5/07-5/09	11. Vacuum/plasma (Ch 10) cont'd Assign #4 Ch 8, 9 due	12. Etch (Ch 11) SR
5/14-5/16	13. PVD: Physical Vapor Deposition (Ch 12) Assign #5 Ch 10 due	14. CVD: Chem Vapor Depos'n (Ch 13) SRII
5/21-5/23	14. Epitaxy (Ch 14) Assign #6 Ch 11, 12 due	16. Back-end Processing (Ch 15) & Manufacturing (Ch 20)
5/28-5/30	Memorial Day	Final Exam (lectures 10-16) Assign #7 Ch 13, 14, 15/20 due
6/04-6/06	Graduate presentations	No lecture
	Exam week	

Lectures: Read the appropriate chapter before each lecture.
Lecture notes will be posted at www.ece.pdx.edu/~jmorris/ece_416_&_516_IC_Technologies
Recitations: "SR" = Silicon Run; videos from this series will be run Wed 6.00-6.30pm in UTS208 as shown.

	This syllabus is a plan! Changes will be posted at www.ece.pdx.edu/~jmorris/ece_416_&_516_IC_Technologies.
Class time:	Lectures: Monday, Wednesday 18:40-20:30 UTS-208 Recitation:
Instructor:	Professor James E. Morris Office FAB 160-13; Tel: (503)725-9588; jmorris@ece.pdx.edu
Office Hours:	Monday 4-5pm; Wednesday 10-11am
Course Objectives:	Students should be able to: • Explain the process flow for different microelectronic processes. • Describe the processing steps (including the chemical and physical basis,) manufacturing techniques, measurement techniques, and important output parameters. • Relate device characteristics to key process parameters. • Use design rules to layout simple circuits and calculate yield.
Main Topics:	Microelectronic processing of solid-state devices and integrated circuits. Process techniques such as lithography, oxidation, diffusion, film deposition, etch, ion implantation, and back-end processing will be discussed. Integration of processes for bipolar, CMOS, BiCMOS, and MEMS fabrication processes. Defining system rules for IC layout. Packaging and yield.
Prerequisite:	ECE 415/515 Fundamentals of Semiconductor Devices is listed in the Bulletin, but may be waived upon request.
Course website	Syllabus, notes, homework, etc. all on course website at www.ece.pdx.edu/~jmorris/ece_416_&_516_IC_Technologies. You must check before every class. Students will find it useful to print out notes prior to class, or to view them on-line during class.

Required Textbooks:	***Fabrication Engineering at the Micro- and Nanoscale,*** Stephen A. Campbell, Oxford University Press 2008, ISBN 978-0-19-532017-6	
Assignments and Grading:	ECE416 40% Homework 30% Mid-term 30% Final	ECE516 30% Homework 25% Mid-term 25% Final 20% Project/presentation
Homework:	Problem assignments will be set one week before each due date in the Monday lecture (except for Assignment #7). Homework will be checked for satisfactory completion, but students will be responsible for using the solutions provided for one week following the due date to check the details of their own work. No credit for late homework.	
Presentation:	Graduate students will do a presentation to the class in the last week of the term.	
Class Etiquette:	Students are expected to complete the assigned reading prior to class, attend regularly, participate, and complete all assigned work. Turn off all cell phones.	
Collaboration:	No collaboration allowed. Any signs of copying another's work or solution manuals will result in both papers receiving no credit and may be written up as a code of conduct violation. See www.ess.pdx.edu/osa/osa_b.htm.	
Reference Books, Semiconductor Fabrication:	S.Franssila ***Introduction to Microfabrication*** Wiley 2010 (2nd ed.) ISBN 978-0-470-74983-8 James D. Plummer, Michael D. Deal and Peter B. Griffin, ***Silicon VLSI Technology: Fundamentals, Practice and Modeling***, Prentice Hall, Upper Saddle River, New Jersey, 2000, ISBN 0-13-0850037-3. Richard C. Jaeger, ***Introduction to Microelectronic Fabrication***, Prentice Hall, 2002. (2nd ed.) ISBN 0-201-44494-1. Gary S. May, Simon M. Sze, ***Fundamentals of Semiconductor Fabrication***, Wiley, 2004. S. Wolf and R.N. Tauber, ***Silicon Processing, vol. 1***, (Lattice Press) S.Wolf and R. N. Tauber, ***Silicon Processing for the VLSI Era***. (Lattice Press, 2000)	
Reference Books, Device Physics	Streetman, B.G. *Solid State Electronic Devices*, Prentice Hall, Fifth Edition, 2000. Muller, R.S., and T.I Kamins. *Device Electronics for Integrated Circuits*. NY: Wiley, 1986. *Modular Series on Solid-State Devices, Volumes I-IV*. Reading, MA: Addison-Wesley.	
Reference Journals:	IEEE Transactions on Semiconductor Manufacturing, IEEE Transactions on Electron Devices, IEEE Electron Device Letters, Semiconductor International (trade magazine, not peer reviewed)	
Accommodation:	If you have a recognized disability and are in need of academic accommodations, please notify me (the instructor) immediately to arrange needed support. For more information about the Disability Resource Center, see http://www.pdx.edu/iasc/drc.html.	
Links of interest:	NanoHUB (NSF supported resource center at Purdue): http://nanohub.org Multi-media streaming videos: http://www.multimedia.vt.edu/ee-mse/ Simulation applets: http://jas2.eng.buffalo.edu/applets/ International Technology Roadmap for Semiconductors web site: http://public.itrs.net/ Chip Shots Gallery: http://micro.magnet.fsu.edu/chipshots/index.html Microfabrication Principles Learning Space (web based learning and self tests) http://www.jhaj.net/jasjeet/tcad/index.html *UofL MicroTechnology Web Site* http://mitghmr.spd.louisville.edu *Introduction to Microengineering* by Dr. Daniel Banks http://www.dbanks.demon.co.uk/ueng/ *Microsystems, Microsensors & Microactuators* by Dr. Daniel Banks http://www.dbanks.demon.co.uk/ueng/	

	Introduction to Microengineering - Supplement by Dr. Daniel Banks http://www.ee.surrey.ac.uk/Personal/D.Banks/roughgui.html *MUMPS Design Handbook* by Cronos (Koester, Mahadevan, Shishkoff and Markus) http://www.memsrus.com/cronos/svcsmumps.html http://www.memsrus.com/cronos/mumps.pdf An Introduction to Microelectronics Manufacturing and Markets http://bmrc.berkeley.edu/courseware/ICMfg92/

Recommended supplementary lab course: ECE 410/510 Nanomaterials Fabrication (LaRosa)
2 credits

Thursday: PH1 8am-noon or PH2 1-5pm,

SRTC405