ECE 396K - Spring 2007
Semiconductor Microlithography

Unique #16558
Room: BUR 220
TTh 11:00am – 12:30 pm

Instructor: Chris Mack, chris@lithoguru.com

Office Hours by Appointment

Text: Fundamentals of Optical Lithography: The Science of Microfabrication, by Chris Mack (John Wiley & Sons, 2007).

Prerequisite: graduate student standing

Grading:		
	Homework	15%
	Exam #1	35%
	Exam #2	40%

Course Outline:

I. Introduction to Microlithography

II. Optical Exposure Systems

III. Diffraction, Fourier Optics and the Aerial Image

IV. Standing Waves and Swing Curves

V. Photoresist Processing

VI. Exposure and Resist Chemistry

VII. Photoresist Development

VIII. Process Optimization, DOF, Process Control

IX. Resolution Enhancement Technologies

Homework assignments will always be due one week from the date assigned at the beginning of class. Late submissions will not be accepted. Working in groups on homework assignments is acceptable, copying is not.

When a problem asks you to ‘derive’ an answer, I expect you to work through the math yourselves. Otherwise, you are free to look up intermediate results (Fourier Transform table, an integral solved using Mathematica, etc.) so long as you site the source used in your solution.

Reading assignments are important! Please have all assigned material read before each class.

Tests will be in-class, open book and notes.

Semiconductor Microlithography -- Approximate Class Schedule

Class	Topic	Material Covered
Week 1	Introduction, semiconductor industry overview	1.1, 1.2
	Lithography process overview	1.3
Week 2	Electromagnetic radiation	2.1 (through 2.1.3)
	Plane waves, Intensity	Finish 2.1
Week 3	Diffraction, Fourier transforms	2.2
	Aerial image formation, oblique illum.	2.2.5, 2.3.1
Week 4	Partial coherence	Finish Chap. 2
	Aberrations	3.1
Week 5	Flare, defocus	3.3, 3.4
	Defocus	3.4
Week 6	Vector imaging, image metrics	3.6, 3.8
	Standing waves	4.1.1, 4.1.2
Week 7	Swing curves	4.1.3, 4.1.4, 4.2
	Top and bottom ARCs	4.3, 4.4
Week 8	Exam #1	
	Absorption, exposure kinetics	5.1, 5.5
Week 9	Diffusion, PEB	5.3, 5.4
	Chemically amplified resists	6.1, 6.2
Week 10	Reaction-diffusion, acid loss, quencher	6.2, 6.3
	Dissolution kinetics	7.1
Week 11	Resist contrast, develop path	7.2, 7.3
	Critical dimension control	8.1, 8.2
Week 12	Focus exposure, process window, DOF, MEEF	8.5, 8.7
	Image log-slope, exposure optimization	9.1 – 9.4
Week 13	PEB, reaction-diffusion optimization	9.5
	Development, contrast, exposure latitude	9.6, 9.7
Week 14	RET – Optical proximity correction	10.1, 2
	RET – Off-axis illumination	10.3
Week 15	RET – Phase shifting masks	10.4
	Exam #2	