PHY 141 Applied Optics
4 credits (3 hour lecture, 2 hour lab)

Prerequisites: MAT 109 (Intermediate Algebra); and PHO 101; or permission of the instructor
Corequisites: MAT 141 (Precalculus)

This course is the second semester in a sequence to introduce optics and its applications. Building on the foundations of PHO 101 Introduction to Photonics, you will study more involved systems of lenses, including stops, pupils and windows and aberrations. Matrix methods will be introduced. Topics from wave optics include coherence, types of interferometers and their uses, thin films, Fresnel and Fraunhofer diffraction, scattering, production and modification of polarized light. Natural and industrial applications of optical phenomena will be emphasized.

The laboratory parallels the classroom lectures. You will construct and evaluate multiple lens systems and various interferometers using both rail and breadboard systems. Classroom demonstrations, Internet web sites, and in-class mini labs and team projects will be used extensively.

Required Text:
Introduction to Classical and Modern Optics, Fourth Edition; J.R. Meyer-Arendt, Prentice Hall. (This book is out of print, but copies are available in the bookstore.)

References:
Pedrotti and Pedrotti, *Introduction to Optics, Ed 4*, Prentice Hall 1993
This is an advanced text, available in the TV campus library.
Hecht*, Optics, Ed 4*, Addision Wesley, 2002.
This is also an advanced text, with beautiful photos of optical phenomena.

Web sites will be used for reference and to perform "pre lab" experiments. You must have internet access and an email account. The lab will be open during the day Monday through Friday to allow you to use access the internet if you do not have access at home.

Attendance Policy
Students are expected to attend all classes, to be on time and to be prepared. I will take attendance every day. Students who miss classes don't do as well as those who attend regularly. No cell phones!

Homework
Homework will be assigned for every class. You are expected to make a good effort to solve the homework problems- if you get stuck, the solutions to many problems are in the file cabinet in Room 105. Be sure you understand each problem that is assigned- if you don't, ask in class to see the solution, send me an email, or come to office hours for help.

Course Outline with Approximate Hours

Review of optics and ray tracing	3	
Review of thin lenses and imaging	3	
(Take home review test)		
Thick Lenses: principle planes, equivalent power front and back vertex power	4.5	
Matrix methods: matrix algebra, refraction, translation and thin lens matrix, system matrix	4.5	
IN CLASS TEST: THICK LENSES	1.5	
Aberrations: description of 5 seidel; calculation of correction for spherical aberration and chromatic aberration	4.5	
Apertures, stops and pupils	4.5	(LAB TEST: design)
Absorption and Scattering	1.5	
Review of Interference/Diffraction gratings	3	
Thin films and air wedges	3	
(Take home test: Interference)		
Diffraction/resolving power	3	
Polarization	6	
Holography	3	
IN CLASS TEST: WAVE OPTICS (final exam week)		

TENTATIVE LAB EXPERIMENTS

Filter characterization	Negative lens focal length
Air wedge	Spherical mirror focal length
n for air- Michelson interferometer	Equivalent lenses
single slit diffraction	Matrix Methods
Malus' law	Aberrations
Identification of polarization state	Lens design
Two thin lenses	Telescope design

Exam Policy

Several tests are scheduled- some in class and some take home. Teamwork is not discouraged on take home tests- in fact, it is encouraged as long as all members of the team are equally involved. For in class exams, a sheet of equations will be allowed.

Makeup exams will only be given in the case of serious illness or other bona-fide excuse. Students may be asked for appropriate documentation to schedule a make-up exam.

If it becomes evident that the class is not putting sufficient effort into completing homework assignments, there will be pop quizzes as well. These will be open book but time limited.

Laboratory Reports

Each lab will have specific items that need to be handed in. Be sure to find out what is expected of you before leaving the lab for the day. Most labs will be graded on the basis of 10 points, but some may only be checked off that they were completed.

ALL labs are expected to be neat and complete. Labs that are not complete will not be graded.

No lab reports will be accepted more than 2 weeks after the experiment is completed, or after the graded lab is returned to the class.

Grade Determination

The final grade will consist of:

Tests (including any quizzes):	75%	
Labs (formal and informal):	25%	**(You must pass the lab to pass the course)**

Students with disabilities

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact the Disabilities Counseling Services at 383-5240. To avoid any delay in the receipt of accommodations, you should contact the counselor as soon as possible. Please note that I cannot provide accommodations based upon disability until I have received an accommodation letter from the Disabilities Counselor. Your cooperation is appreciated.