

Three Rivers Community-Technical College
PHO 101 Introduction to Photonics
3 Credits (4 class hours/week)

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Room 105 (back)

Course Description:

Optics is the science of light and this course is designed to introduce you to basic concepts necessary for further study of the nature and applications of light. We will explore the nature of light, learn where light comes from and the units used to measure light, the laws of reflection and refraction and how these lead to image formation, the nature of waves, and the wavelike behavior of light. We will explore applications in nature and technology for every concept we present.

All concepts will be reinforced through regular homework assignments, demonstrations and computer simulations (including applets found on the internet.) All students need to have internet access (we also do a lot of communicating by email); the lab will be open during the week so that students who do not own a computer can complete assignments.

This course is taught mostly through analysis and discussion of hands-on activities so it is very important that you attend each and every class!

Text:

- **LIGHT: Introduction to Photonics** Textbook (available at <http://stores.lulu.com/PHOTON2>) There are also reference copies in the lab.
- There are some books that might be handy for reference (these may be found in the Thames Valley Campus Library or the lab library). Some of these are at a high math level.
 - Pedrotti and Pedrotti, Introduction to Optics, Prentice Hall (requires advanced calculus)
 - Wilson and Buffa, College Physics (or other high school or college physics text)
 - Photonics Spectra and Laser Focus World (these are monthly trade journals you can subscribe to for free)
 - Hecht, Optics Edition 4, Addison Wesley (this also has calculus, but the drawings and photos are wonderful)
 - Videos The Thames Valley Campus library has a complete set of videos on fiber optics theory and installation. Videos are also available on careers in optics, as well as on laser safety and applications. Some of these videos may be taken from the library, others must be viewed in the library (ask at the desk)

There are many online resources as well- check out www.lasertechonline.org for a listing.

Prerequisites/Corequisites:

MAT 095 is a corequisite (or instructor's permission). This course is acceptable for students who have not passed ENG 100 or did not place into ENG101 on the placement test..

PHO 101 Introduction to Photonics

Topics:

Light sources

- Electromagnetic spectrum
- Production of light (atomic theory)
- Source characteristics

Geometric optics

- Shadows and pinhole cameras
- Law of reflection (plane mirrors, spherical mirrors)
- Law of refraction (index of refraction, total internal reflection, optical fiber)
- Prisms (uses of prisms)
- Lenses (converging, diverging, Lensmaker's equation, thin lens equation for problems with one and two lenses)
- Optical Instruments using lenses (microscope, telescope, eye, corrective lenses as time permits)

Introduction to Wave Optics

- Vibrations and Waves
- Superposition/2-slit experiment
- Holography and interferometry
- Diffraction
- Polarization

Hands-on Experiments (Labs): This is a suggested list. You will do a lab experiment in nearly every class. Ideally, you *will learn by doing*, not by being told.

"Scavenger Hunt" (PHOTON kit)	Refraction at a curved surface/lensmakers'
Spectra of light sources	Thin lens equation/imaging
Reflection-Fermat's principle	Wave properties (mechanical waves)
Refraction-Fermat's principle	Two slit experiment
Snell's Law	Holography/Interferometry
Cleaning optical elements	Diffraction Gratings
Laser Beam Alignment	Diffraction/measurement of a hair
Ray tracing	Diffraction- Airy disk
Prisms	Polarization

Lab Reports

Some labs will be informal and you will turn in a data sheet and calculations, and questions on your methods and results. Other labs will require a more complete analysis. You will be instructed on they details before each experiment begins. Some labs will just be checked (+ or -) and other labs will be graded out of 10 points. Lab due dates depend on the complexity of the lab- pay attention to this information when it is given out in class.

If you miss a lab, you will need to make arrangements with the instructor or the lab

technician to make it up.

Tests

Tests will focus material you will need to know for succeeding optics courses. Open-ended questions based on industry applications will also be included. You will be allowed the use of one 8.5 x 11" page of notes for each test. Some tests may be take home, with group work encouraged.

Final grade

Tests and quizzes	60%
Class Participation*	15%
Hands-on activities	25%

* The class participation grade will depend first and foremost on attendance. Being on time with homework completed are other factors that will be considered; I reserve the right to collect homework once in a while and use it toward the class participation grade. Occasional assignments, such as research on companies we will visit, will be graded and included in this category.

Cell phone policy: Cell phones must be turned off during class or lab activity time.

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.