EECE4646
Spring 2014

OPTICS FOR ENGINEERS

file #11945syl:Rev 1

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http://www.ece.neu.edu/courses/eece4646/2014sp/
Faculty Website:
http://www.ece.neu.edu/faculty/dimarzio/
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http://www.ece.neu.edu/groups/osl

VIRTUAL OFFICE HOURS: Students' questions don't always come at a time convenient for office hours. Please feel free to email me at any time for "virtual office hours." If you think the question will be of general interest, and you are willing, please give me permission to post your question (without your name) and my answer, for the benefit of other students. I will never do this without your explicit permission. If multiple students have similar questions, I may post a generic response, so look on the announcements page.

OFFICE HOURS: Sometimes only real office hours will work. I will be available in the time–honored way.
Times TBD (216 Lake) or by appointment

TEXT: DiMarzio, Charles A., *Optics for Engineers*, CRC Press. 2011.
(http://www.crcpress.com/product/isbn/9781439807255)
After trying for many years to find a suitable text for this course, I decided to write one. Please report any errors, any areas that you find difficult or confusing, and any other comments you may have.

LOCATION: 010WVF

TIME: Tue, Fri 9:50 AM – 11:30 AM

GRADING:

Mid–Term	25%
Final	25%
Homework	25%
Project Final Report	25%

PROJECTS: A list of suggested projects will be distributed. Each project must involve some research in the literature and some independent work. Reviews of the literature alone are not acceptable. If you have your own idea for a project, I would be happy to consider it. I will suggest other projects during class as they arise in the lectures.

HOMEWORK: Homework Assignments will be available on the course website. Collaboration among students on homework is acceptable and encouraged. Group submissions will be accepted from groups of up to three students, and a single grade assigned for all members of the group. Nevertheless, it is the responsibility of each student to have a good understanding of each problem.

TENTATIVE SCHEDULE

1 **7, 10 Jan**	**ADMINISTRIVIA. INTRODUCTION;** — History, The spectrum, Perception of color, specular and diffuse reflection, Maxwell's Equations, the wave equation, Fermat's Principle. **Textbook Chapter:** 1.
2 **14, 17 Jan**	**BASIC GEOMETRIC OPTICS:** Imaging, ray optics, ray tracing. Refraction at a single surface, total internal reflection, simple optical elements, focal length. **Textbook Chapter:** 2. **Homework:** Problems from Ch. 1 Due 14 Jan.
3 **21, 24 Jan**	**MATRIX OPTICS:** Basic transformations, system matrix. Cascading matrices. CARDINAL POINTS: Application to representative systems. Thick lens, air–spaced doublet. **Textbook Chapter:** 3. **Homework:** Problems from Ch. 2 Due 21 Jan.
4 **28, 31 Jan, 4 Feb**	**STOPS AND APERTURES:** Entrance and exit pupils. Entrance and exit windows. Object and image space. OPTICAL INSTRUMENTS: Microscope, magnifier, compound microscope, Heads–up display. **Textbook Chapter:** 4. **Homework:** Problems from Ch. 3 Due 28 Jan.
5 **7, 11 Feb**	**ABERRATIONS:** Spherical aberration, other third–order aberrations, matrix methods, exact ray tracing, wavefront methods. **Textbook Chapter:** 5. **Homework:** Problems from Ch. 4 Due 7 Feb.

6 **14, 18, 21, 25, 28 Feb**	**POLARIZED LIGHT:** INTERFACE OPTICS: The wave equation, plane waves, Fresnel reflection and refraction at a dielectric interface. JONES CALCULUS: representations and transformations. MIDTERM EXAM 28 February in class **Textbook Chapter:** 6. **Homework:** Problems from Ch. 5 Due 14 Feb. **Homework:** Problems from Ch. 6 Due 25 Feb.

Spring Break 3 – 7 March (Ski Time)

7 **11, 14, 18 Mar**	**INTERFERENCE:** The Mach–Zehnder and Michelson interferometers, The Fabry–Perot — laser line selection and tuning. Multi–layer coatings including matrix representation. **Textbook Chapter:** 7.
8 **21, 25 Mar**	**DIFFRACTION:** Interference, Multiple beams, slits and apertures, transmissive and reflective gratings. Littrow gratings. The Fresnel–Kirchoff integral. A/O Modulators. **Textbook Chapter:** 8. **Homework:** Problems from Ch. 7 Due 21 Mar.
9 **28 Mar**	**GAUSSIAN BEAMS:** Derivation and computational techniques. The complex radius of curvature. Graphical solutions. **Textbook Chapter:** 9. **Related Sections in Notes:** 8.
10 **1 Apr**	**COHERENCE:** Coherent and incoherent light, partial coherence, visibility. Coherent and incoherent imaging. Brief comments on quantum theory of coherence, and squeezed states. **Textbook Chapter:** 10. **Homework:** Problems from Ch. 8,9 Due 1 Apr.
11 **4 Apr**	**FOURIER OPTICS:** point spread function, modulation transfer function. Simple optical data processing. Holiday, 23 Nov. **Textbook Chapter:** 11.

12 **8, 11, 15 Apr**	**INCOHERENT SOURCES:** The black body spectrum, coherent and incoherent sources. Polar bears. **RADIOMETRY:** Quantities and units, basic measurements, photometry. **Textbook Chapter:** 12. **Homework:** Problems from Ch. 10,11 Due 8 Apr. **Homework:** Problems from Ch. 12 Due 18 Apr.

***** Project Due 24 Apr *****

***** Final Exam TBD *****

Grades Due to Registrar on 28 Apr, 9:00AM. Grades will be available on the Banner system.