EECE4646— OPTICS FOR ENGINEERS— Spring 2017

Syllabus

INSTRUCTOR:	Charles A. DiMarzio, Associate Professor Electrical and Computer Engineering Lab: 334 Egan Mail: 409 Dana Office: 302 Stearns Northeastern University Boston, Massachusetts 02115 Phone: 617–373–2034 Electronic Mail: dimarzio@ece.neu.edu Course Website: http://www.ece.neu.edu/courses/eece4646/2017sp/ Faculty Website: http://www.ece.neu.edu/faculty/dimarzio/ Research Lab Website: http://www.ece.neu.edu/groups/osl

OFFICE HOURS:	TBD Feel free to email questions as well.

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. We are using it this semester for the first time. Please report any errors, any areas that you find difficult or confusing, and any other comments you may have.

GRADING:	25 % on homework (Equal weight on best $n-1$ of n assignments 25 % on mid–term exam 25 % on project 25 % on final exam.

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EXAMS:	Take–home exams will be given at the middle and end of the course. You will have about one week to complete each. It is expected that your exam submission will be the result of your own effort, with the aid of your notes, the text, and other reference books. Please work independently. Do not collaborate or seek help from other experts. Exams not received by the due date will receive a grade of "F."

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 four 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	9,12 Jan	ADMINISTRIVIA. INTRODUCTION; — History, The spectrum, Perception of Color, specular and diffuse reflection, Maxwell's Equations, the wave equation, Fermat's Principle. **Reading:** 1.

Monday 16 Jan — MLK Holiday: No class

2	19,23,26 Jan	BASIC GEOMETRIC OPTICS: Imaging, ray optics, ray tracing. Refraction at a single surface, total internal reflection, simple optical elements, focal length. **Reading:** 2. **Homework:** Problems from Ch. 1 & part of 2 Due 23 Jan. **Homework:** Remaining Problems from Ch. 2 Due 30 Jan.

3	30 Jan, 2 Feb	MATRIX OPTICS: Basic transformations, system matrix. Cascading matrices. CARDINAL POINTS: Application to representative systems. Thick lens, air–spaced doublet. Meeting Travel **Reading:** 3.

4	6,9,13 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. **Reading:** 4. **Homework:** Problems from Chapters 3, & 4 Due 16 Feb..

5	16 Feb	ABERRATIONS: Spherical aberration, other third–order aberrations, matrix methods, exact ray tracing, wavefront methods. **Reading:** 5. **Homework:** Problems from Chapter 5 Due 23 Feb.

Monday 20 Feb — Presidents' Holiday: No class

Mid–Term Exam handed out 23 Feb, due 2 Mar

6	23,27 Feb 2 Mar	POLARIZED LIGHT: INTERFACE OPTICS: The wave equation, plane waves, Fresnel reflection and refraction at a dielectric interface. JONES CALCULUS: representations and transformations. Partial polarization, including coherency matrices and Mueller Calculus. Optical activity. Poincaré Sphere. **Homework:** Problems from Chapter 6 Due 13 Mar. **Reading:** 6.

Monday 6 Mar to Friday 10 Mar — Spring Break

7	13,16 Mar	INTERFERENCE: The Mach–Zehnder and Michelson interferometers, The Fabry–Perot — laser line selection and tuning. Multi–layer coatings including matrix representation. **Reading:** 7. **Homework:** Problems from Chapter 7 Due 20 Mar.

8	20,23 Mar	DIFFRACTION: Interference, Multiple beams, slits and apertures, transmissive and reflective gratings. Littrow gratings. The Fresnel–Kirchoff integral. A/O Modulators. **Reading:** 8. **Homework:** Problems from Chapter 8 Due 27 Mar.

9	27,30 Mar	GAUSSIAN BEAMS: Derivation and computational techniques. The complex radius of curvature. Graphical solutions. Higher–order modes. **Reading:** 9. **Lecture Notes:** 8 **Homework:** Problems from Chapter 9 Due 3 Apr.

10	3 Apr	COHERENCE: Coherent and incoherent light, partial coherence, visibility. Coherent and incoherent imaging. Brief comments on quantum theory of coherence, and squeezed states. **Reading:** 10.

11	6 Apr	FOURIER OPTICS: point spread function, modulation transfer function. Simple optical data processing. **Reading:** 11. **Homework:** Problems from Chapters 10, 11, Due 10 Apr .

12	10,13 Apr	INCOHERENT SOURCES: The black body spectrum, coherent and incoherent sources. Polar bears. RADIOMETRY: Quantities and units, basic measurements, photometry. **Reading:** 12.

Monday 17 Apr — Patriots' Day Holiday: No class

Project Due 13 Apr

Final Exam handed out Wed., 19 Apr due Wed., 26 Apr

Grades Due to Registrar on 1 May at 9:00AM.
