

# EECE4646— OPTICS FOR ENGINEERS— Spring 2024

## Syllabus

<b>INSTRUCTOR:</b>	Charles A. DiMarzio, Associate Professor Electrical and Computer Engineering Lab: 352 Egan Office: 302 Stearns Mail: 409 Dana Northeastern University Boston, Massachusetts 02115 Phone: 617-373-2034 Electronic Mail: dimarzio@ece.neu.edu Course Website: <a href="http://www.ece.neu.edu/courses/eece4646/dimarzio/">http://www.ece.neu.edu/courses/eece4646/dimarzio/</a> Faculty Website: <a href="http://www.ece.neu.edu/faculty/dimarzio/">http://www.ece.neu.edu/faculty/dimarzio/</a> Research Lab Website: <a href="http://www.ece.neu.edu/groups/osl">http://www.ece.neu.edu/groups/osl</a>
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<b>OFFICE HOURS:</b>	TBD Feel free to email questions as well.
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<b>TEXT:</b>	<b>Reference only:</b> DiMarzio, Charles A., <i>Optics for Engineers</i> , CRC Press. 2011. ( <a href="http://www.crcpress.com/product/isbn/9781439807255">http://www.crcpress.com/product/isbn/9781439807255</a> ) 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.
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<b>GRADING:</b>	25 % on homework (Equal weight on best $n - 1$ of $n$ assignments) 20 % on mid-term exam 25 % on project 20 % on final exam. 10 % on participation
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<b>EXAMS:</b>	Two exams will be given, one at the middle and one during finals week.
<b>PROJECTS:</b>	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.
<b>HOMEWORK:</b>	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 two students, and a single grade assigned for both members of the group. Nevertheless, it is the responsibility of each student to have a good understanding of each problem.
<b>PARTICIPATION:</b>	To earn a good grade for participation, attend class regularly, be well-prepared for the topic of the day, participate in discussions, speak up when you have a question, discuss your project with me.

## Tentative Schedule

<b>1</b>	9,12 Jan	<p>ADMINISTRIVIA. INTRODUCTION; — History, the spectrum, perception of color, specular and diffuse reflection, Maxwell's Equations, the wave equation, Fermat's Principle.</p> <p>GEOMETRIC OPTICS: Reflection and refraction. Total internal reflection (Snell's window and fibers). Retroreflectors.</p>
<b>2</b>	16,19 Jan	<p>GEOMETRIC OPTICS: One lens. two lenses. Lens shapes and aberrations. Apertures (Aperture stops, f/number, NA, field stops). Ray tracing.</p> <p><b>Homework:</b> TBD.</p>
<b>3</b>	23,26 Jan	<p>CAMERAS: Pixels, bit depth, speed, color, hyperspectral.</p> <p><b>Homework:</b> TBD.</p>
<b>4</b>	30 Jan, 2 Feb (PW)	<p>POLARIZATION: Devices, Eigenvectors, Analysis. Malus Law.</p> <p>Term Project: Select topic. Do a literature search. Email a short paragraph.</p> <p><b>Homework:</b> TBD.</p>
<b>5</b>	6, 9 Feb	<p>POLARIZATION: Fresnel Reflection, Brewster's Angle. T/R Beamsplitter. LCD Display. Partial polarization, briefly.</p>

<b>6</b>	13, 16 Feb	<p>INTERFERENCE: Coherent and Incoherent light. Mach-Zehnder interferometer.</p> <p>MIDTERM EXAM: In class 16 Feb.</p> <p>Term Project: Plan for implementation.</p> <p><b>Homework:</b> TBD.</p>
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<b>7</b>	20,23 Feb	<p>INTERFERENCE: Doppler lidar. The Fabry-Perot — laser cavities and frequency. Multi-layer coatings.</p> <p><b>Reading:</b> 7.</p>
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<b>8</b>	27 Feb, 1 Mar	<p>DIFFRACTION: Fourier optics. Slits and apertures, Gratings. Apertures, square, circular, Gaussian.</p> <p><b>Homework:</b> TBD.</p>
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Monday 4 Mar to Friday 9 Mar — Spring Break

<b>9</b>	12,15 Mar	<p>DIFFRACTION: Shoot the moon. Images (PSF, OTF)</p> <p>Laser cavities and beam size. Fiber communication.</p> <p>Term Project: Interim report.</p> <p><b>Homework:</b> TBD.</p>
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<b>10</b>	19, 21 Mar	<p>RADIOMETRY: coherent and incoherent sources. Quantities and units. Photometry.</p> <p><b>Homework:</b> TBD.</p>
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<b>11</b>	16, 29 Mar	<p>RADIOMETRY: The black body spectrum. Thermal Cameras. Solar energy. Polar bears.</p>
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<b>12</b>	2,5 Apr	TBD: <b>Homework:</b> TBD.
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<b>13</b>	9, 12 Apr	TBD:
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<b>13</b>	16 Apr	TBD: Oral Reports?
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**Project Due TBD**

**Final Exam:** TBD

**Grades Due to Registrar on Monday 29 April at 9:00AM.**