Course Syllabus

Department/Faculty
School of Engineering

Graduate Program
Electrical Engineering and Computing

Degree
☒ Academic Master's ☒ Doctorate (PhD) ☐ Professional Master's

Course Name:
Optics

Professor(s)*
Eunezio Antonio de Souza

Office hours
48

Course Overview

This course will radically change the way Electrical Engineering students view the world.

We'll discuss intriguing everyday issues such as:

1- Why do windows work as mirrors at night?
2- Does the light really walk in a straight line?
3- Why is the sky blue?
4- Why is there a rainbow?
5- What is the difference between a laser and a lamp?

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Topics outline

Wave motion, electromagnetic theory, propagation of light, geometrical optics, superimposition of waves, polarization, interference, diffraction, Fourier optics, lasers and more...

Topic.	**Reading**
1. Why Optics is cool; a short history of Optics	Hecht 1.1 – 1.5
2. Waves: the wave equation; phase velocity	Hecht 2.1 – 2.8
3. Maxwell's equations; the wave equation and plane waves	Hecht 3.1 – 3.3, Appendix 1
4. The electromagnetic spectrum	Hecht 3.3 – 3.6
5. Lasers	Hecht 13.1
6. Absorption and the refractive index	Hecht 3.5
7. Superposition: standing waves; beats; and group velocity	Hecht 7.1 – 7.2
8. Light scattering; reflection; refraction; coherence; light bulbs	Hecht 4.1 – 4.4.1
9. Fresnel's equations of reflection and refraction	Hecht 4.6 – 4.7
10. Polarization I; polarized light; birefringence; polarizers	Hecht 8.1 – 8.6
11. Polarization II: wave plates; unpolarized light; optical activity	Hecht 8.7 – 8.11
12. Optical activity; Jones vectors and matrices	Hecht 8.13
13. Geometrical optics: ray matrices and ray tracing	notes
14. Fourier series and the Fourier transform	Hecht 7.3 – 7.4
15. Fourier transform examples, theorems, and concepts	Hecht 11.1 – 11.2, 11.3.4
16. More Fourier transforms: convolution and correlation	Hecht 11.3.1, 11.3.2, 11.3.4
17. Instantaneous frequency and chirp	notes
18. Coherence and interference: the Michelson interferometer	Hecht 9.1 – 9.3, 12.1 – 12.3
19. Interferometers and anti-reflection coatings	Hecht 9.4
20. Diffraction and the Fourier transform	Hecht 10.1, 11.3.3
21. Diffraction gratings and lenses as Fourier transformers	Hecht 10.2, 10.4
Other topics (if we have time):	
23. Nonlinear optics and holography	Hecht 13.3, 13.4
24. Ultrafast optics	notes
25. Ultrafast Optics Research Lab tour	notes

Letter Grade Assignment
Grade A (Excellent) - Grade points between 9 and 10
Grade B (Good) - Grade points between 8 and 8.9
Grade C (Satisfactory) - Grade points between 7 and 7.9
Grade D (Unsatisfactory) - Grade points between 0 and 6.9

Texts, Materials, and supplies

Basic: Eugene Hecht, "Optics"
Complementary: G.R. Fowles, "Introduction to Modern Optics"

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