Fall 2024
OPSE 301: Introduction to Optical Science and Engineering

General information: 3 credit hours. M,W: 8:30 AM – 9:50 AM, FMH 403B

Instructor: Brandan Balasingham, (732)-829-9158, brb23@njit.edu

Office Hours: F: 6:00 – 9:00PM or by appointment.

Optional Text: *Physics of Light and Optics* by Peatross and Ware ISBN: 1312929278

Course Content:

Laboratory and lecture. For applied physics, engineering, computer science, or biology majors. Introduces optics and photonics principles with their elementary applications. Topics include speed at light, reflection, refraction, geometric optics, interference and interferometry, polarization, dispersion, birefringence, fiber optics, diffraction, introduction to spectroscopy and ray tracing.

Prerequisite: Phys 121, Math 112, Matlab or Python knowledge

Specific goals for the course

- The student should know the relationships of frequency, wavelength, wave velocity, group velocity, refractive index, intensity, and dispersion
- The students should be able to understand the concepts of rays and wavefronts.
- Student should be able to apply equations of light propagation to determine the solution to different optical problems
- The student should be able to use some form of raytracing software
- The student will have a good understanding of interference and diffraction as well as the ability to solve problems with these principles.
- The student should understand the concepts of light propagation using Maxwell's equations.
- The student should grasp color and how to quantify it. They should understand scattering, dispersion, interference and diffraction gratings.
- The student should understand the mathematical representation of wave polarization as well as its associated states.
- The student should have basic optics related laboratory skills. Students should be able to perform and take data on various optical lab experiments.

Lecture Quiz
Multiple choice lecture quiz to be given at the beginning of class and you will have around 15 minutes to complete each one.

Exams
You will have one midterm and one final exam. There will be open-ended style questions as well as multiple choice.

List of topics to be covered

Week	Topic with Lecture Notes
1	EM Spectrum, Snells Law, ABCD Matrices, Total Internal Reflection
2	Components: Mirrors, Lens, Prisms
3	Electromagnetic Waves, Maxwells Equations
4	Plane Waves, Complex Refractive Index, Energy Density of Fields
5	Color,Dispersion
6	Fresnel Equations, Brewsters Angle, Total Internal Reflection
7	Interference, Young's experiment, Thin Film interference
	MIDTERM EXAM
8	Beats. Group Velocity, Phase Velocity, Michelson Interferometer
9	Intro to Lasers
10	Anisotropic Medium, Polarization of Light, Jones Vectors, Waveplates
11	Polarization of Light, Waveplates, Polarizers
12	Diffraction - Fresnel and Fraunhofer Theory
13	Diffraction Applications, Resolution of Telescope
14	REVIEW for FINAL

Grading Criteria:		
	Final:	30%
	Midterm:	30%
	Lecture Quizzes:	10%
	Labs:	20%
	HW:	10%

Letter Grades: (Curve will be applied at end of semester)

A 100% - 89%, B+ 89.9% - 84%, B 83.9% - 80%, C+ 79.9% - 75%, C 74.9% - 70.0%, D 69.9% - 60%, F <60%,

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