Syllabus: Optics

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Contact

I will be in my office during office hours. If you cannot come during office hours, and are unable to find me in my office otherwise, you can reach me by e-mail.

Objectives

- Understand theoretical foundations of optics.
- Gain experience performing basic optics experiments; optical systems, fiber systems.

Some Thoughts

Your education is your responsibility. Come to class with the relevant material and prepared to study. It is your responsibility to learn any material you may miss because of your absence. You may ask your classmates or me for help in this matter.

Cheating and plagiarism: Cheating and plagiarism are not acceptable. The first instance will cause a zero for the entire assignment and a letter grade reduction in the final grade. A second case will result in failing grade from the course.

Approach

The only way to learn is to wrestle with the material, to trade some sweat. Your job is to struggle with the reading, and come to class with questions. So do be afraid to try studying on your own! I am here to help you learn, so feel free to ask questions.

I suggest skimming the material that will be covered before coming to class. You will likely find this useful, since it will help you place what we do in class in context. I also suggest you review the material soon after class – the sooner the better. I have found that if I review the material within a day or so, I remember the material better and it saves me time in the long run. Do what you must, to learn what you want to learn.

Methods of Assessment

- Homework (3 HWs ×10% + 2 Labs ×10%)
  - HW1: topic 1
  - HW2: topics 2-3
  - HW3: topics 4-5
  - 2 lab reports/technical memos
- Exams (50%)
  Exams will have two parts – closed book conceptual/estimation multiple choice, open book problem solving. Exam format is taken from courses I have taken.
  - 1 mid-term (20%)
  - 1 final (30%)

Topics

The following topics will be covered in the course:

1. Wave Propagation: Maxwell's Equations, Wave solution (pre-requisites: Differential Equations, Electricity and Magnetism), refractive index, propagation in isotropic media, reflection/refraction – dielectric and metal, thin-film.
2. Geometrical Optics: Huygen's principles, optical systems design (pre-requisite: Computer Science 1), **Measurement Laboratory (lens curvature)**
3. Interference: Young's double slit, Rayleigh-Sommerfield (pre-requisite: Calc2), **Measurement Laboratory (wavelength)**
4. Optical Materials: Lorentz model, Drude model
5. Photonics: TIR, waveguide mode calculation (pre-requisite: Differential Equations)

Relevant texts:

Optical Properties of Solids, by Mark Fox; Oxford University Press. ISBN: 978-0198506133

Optics, by Eugene Hecht; Addison Wesley. ISBN: 978-0805385663

Course Schedule

Week	Topic	Reference
1	Maxwell's Equations	
2	Wave solution (pre-req: Differential Equations, Electricity and Magnetism)	
3	Refractive index, propagation in isotropic media.	
4	Reflection/refraction – dielectric and metal, thin-film.	
5	Huygen's principles, optical systems design (pre-requisite: Computer Science 1)	
6	Mid-term Exam	
7	Mid-semester break	
8	**Measurement Laboratory (lens curvature)**	
9	Young's double slit, Rayleigh-Sommerfield (pre-requisite: Calculus 2)	
10	**Measurement Laboratory (wavelength)**	
11	Lorentz model, Drude model of refractive index	
12	TIR, waveguide mode calculation (pre-requisite: Differential Equations) (Bonus)	
13	Review	
14	Finals week	