Syllabus for EECE–4648
International Biomedical Optics

Tentative Schedule: Revised 27 July 2014

Day	Topic	Comment
1	Basic Optics	
2	Basic Optics	Lab Experiments
3	Basic Optics	
4	Spectroscopy	Computational Projects
5	Biology	Student Presentations
6	Biology	Student Presentations
7	Light Propagation	Mie Scattering Calculations
8	Light Propagation in Turbid Media	Bulk Properties & Random Waves.
9	Monte Carlo	Calculations and Student Presentations
10	FDTD Theory and Practice	Computational Projects
11	FDTD Examples and Extensions	
12	PTSD	
13	Diffusion Theory	Computational Projects
14	Diffusion Reconstruction	Student Presentations
15	Microscopy	
16	Microscopy	Student Presentations
17	OCT	
18	PAT	
19	PhotoTheraputics	Student Presentations
20	Phase Conjugation	

Grading:

- Prepared Presentations 25%
- Unprepared Presentations 15%
- Projects and Teamwork 25%
- Lab Experiments 15%
- Overall Participation 20%

Course Objectives: Students will be able to

- Apply some of the concepts of optics,— including the lens equation, diffraction, spectroscopy, and simple radiometry,— to optical systems.
- Understand how the optical properties of normal and pathological tissue, cells, and sub–cellular components affect the design of optical imaging systems.
- Be able to select appropriate optical wavelengths for different imaging applications.
- Understand the differences among deterministic ray–tracing, diffraction theory, Monte–Carlo, FDTD, PSTD, and diffusion theory. Be able to select an appropriate computational technique for a given optical propagation problem.
- Apply these computational techniques to predict light propagation in typical examples of turbid media.
- Understand and explain the different optical imaging techniques that are used in biology and medicine; brightfield, confocal, fluorescence, multi–photon, harmonic generation, photo–acoustic tomography, optical coherence tomography, and diffusive imaging.
- Become familiar with concepts such as phase conjugation for delivering strong light doses through scattering media such as tissue.