

Course Syllabus: Nonlinear Optics (ECE6104)

A. Suggested Textbooks

Nonlinear Optics, 2nd or 3rd Edition
Robert W. Boyd

Photonics: Optical Electronics in Modern Communications, 6th Edition
Amnon Yariv and Pochi Yeh

I recommend buying these two books (available from Amazon.com). They are very good books and will help you in your future research in any optics related research. I have also put these two books in library reserve.

B. Course Information

Pre- or Co-requisites: ECE 5105 and 5106

Schedule: Durham 463, Tuesday and Thursday, 11 am to 12:15 pm.

Instructor: Yong Xu
Email: yong@vt.edu
Campus Phone: 540-231-2464
Office: Whittemore 467
Office Hour: Friday, 10 am to 11:30 am. (Please email in advance.)

C. Grading

Homework:	20%
In Class Presentation:	20%
Midterm Exam:	30%
Final Exam:	30%

Homework: I will assign 4-5 sets of homework for this class. Homework will be posted online using the Scholar System. The due date will be given in the homework assignments. Please do not turn in your homework late. Unless you have very good reason, late homework will not be accepted.

In Class Presentation: I will ask each of you to prepare a 15-20 minutes in-class presentation on a specific topic in nonlinear optics. Each presentation will be followed with a 5 minute question/answer session. Your presentation will be judged on how well you understand the topic you presented and the quality of your presentation.

Midterm and Final Exams: Both exams will be take home and open book exams. You are free to consult any reference books, journal papers, lecture notes, and homework solutions.

Honor Code: It is OK to discuss homework problems with other students. But the answers must be your own and you cannot copy other people's work. For all take home exams, you must finish them independently. You CANNOT discuss any take home exam problems with each other. Any violation will be referred to the honor court.

D. Course Materials and Management

All course materials will be uploaded to the Scholar website, under the "Resources" section. I have created multiple file folders for different course materials. For example, all course lecture notes will be uploaded under the "Lecture Notes" section. Similarly, all homework will be posted under the "Homework Assignments" section. Supporting materials such as journal papers will be uploaded under the "Reference Materials" section.

E. Course Topics (Tentative)

1. Introduction and Nonlinear Maxwell's Equations
2. Second Order Nonlinearity
 - 2.1. General Analysis
 - 2.2. Second Harmonic Generation
 - 2.3. Phase Matching and Quasi Phase Matching
 - 2.4. Optical Parametric Oscillation
3. Third Order Nonlinearity
 - 3.1. General Analysis
 - 3.2. Four Wave Mixing
 - 3.3. Optical Phase Conjugation
 - 3.4. Optical Kerr Effects
 - 3.5. Optical Soliton
4. Raman Scattering
 - 4.1. Spontaneous Raman Scattering
 - 4.2. Stimulated Raman Scattering
 - 4.3. Coherent Anti-Stokes Raman Scattering
5. Brillouin Scattering
 - 5.1. Spontaneous Brillouin Scattering
 - 5.2. Stimulated Brillouin Scattering
6. Multiphoton Absorption and Microscopy