Course Syllabus

VE 534 Optics and Photonics

Course Description:

This course is an introduction to the fundamentals of optics and photonics at the graduate level. It lays a foundation for further study and research in the area. It includes fundamental theories of optics and photonics at the graduate level, lightwave propagation in free space and confining structures, interaction between light and matter in dielectric, semiconductor, plasmonic and nanoscale devices. FDTD methods for solving Maxwell equations are also introduced.

Instructor:

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Textbook:

[1] Amnon Yariv and Pochi Yeh, Photonics: optical electronics in modern communications, 6th ed, Oxford University Press, 2007.

Additional references

[2] Joseph T. Verdeyen, Laser Electronics, 3rd ed, Prentice Hall, 1981.

[3] Lukas Novotny and Bert Hecht, Principles of Nano-Optics, Cambridge, 2006.

[4] Eugene Hecht, Optics, 4th ed, Addison Wesley, 2002.

Course Prerequisites:

Ve 434 Principles of Photonics, or graduate standing.

Grading Policy (Assignments %, Project, Exams, etc.):

Homework 20%, project 30%, and final exam 50%.

Teaching Schedule:

1. Review of Electromagnetics
2. Free space optics: Gaussian beam, Bessel beam, Airy beam
3. Guided wave optics and surface plasmons
4. Optical resonances and microcavities
5. Coupling theories for waveguides, resonators and polarization rotation
6. Laser principles and rate equations
7. Periodic structures including DBR gratings, DFB lasers, Photonic bandgap structures and related calculation methods
8. FDTD methods for Electromagnetics
9. Mie scattering
10. If time allows, will discuss metamaterials, optical force, etc.