ECE4500 Course Syllabus

ECE4500

Optical Engineering (3-0-0-3)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Elective for the EE degree.

Lab Hours

0 supervised lab hours and 0 unsupervised lab hours

Course Coordinator

Gaylord,Thomas K

Prerequisites

ECE 3025 [min C]

Corequisites

None

Catalog Description

Introduction to applications of geometric & physical optics to engineering, including optical measurements, matrix methods, instruments, interference, holography, beam optics, Fourier optics & diffraction.

Textbook(s)

F. L. Pedrotti, L. S. Pedrotti & L. M. Pedrotti, *Introduction to Optics* (3rd edition), Prentice Hall, 2007. ISBN 9780131499331 (required)

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Design and implement optical components and imaging systems using geometrical optics.
2. Describe and analyze modern photonic systems for display, data storage, communication, and illumination.
3. Design and characterize optical sources, including fluorescence, light emitting diodes, lasers, etc.
4. Analyze light waves and their characteristics such as optical interference, diffraction, polarization, etc.
5. Analyze and implement optical waveguides used in fiber communications and integrated photonics.

Student Outcomes

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.

"LN" for "little to none" indicates that the course does not contribute significantly to this outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (LN) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (LN) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (LN) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

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Modern Optical/Optoelectronic Systems
  Communications; Data Storage; Display; Spectroscopy; Detection; I
Optical Sources and Measurements

  Blackbody Radiation
  Light Sources / Light Emitting Diodes (LED)
  Lasers
  Coherence (Spatial /Temporal )
  Radiometry / Photometry
Geometrical Optics (Image Formation)

  Reflection and Refraction at a Spherical Surface
  Thin and Thick Lenses
  Optical Components
          Lenses, Mirrors, Prisms, Beam Splitters
  Aberrations in Optical Systems
  Optical Instruments
            Microscopes, Telescopes

Electromagnetic  Optics
  Polarized Light
          Reflection and Refraction
          Brewster's Angle
  Interference
  Diffraction
          Fraunhoffer
          Fresnel
  Grating Diffraction

Waveguide Optics
  Planar waveguides
  Fiber optics
  Phase and Group Velocity
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- Dispersion

Fourier Optics and Holography

- Optical Fourier Transforms
- Holography
  - Production of Holograms
  - Holographic Nondestructive Testing
- Optical Data Processing
  - Pattern Recognition
  - Image Enhancement
- Optical Memories