

OPTI 500E- Photonic Communications Engineering II E

Course Description:

Photonic Communications Engineering (PCE) consists of two parts (I and II). PCE I covers optical fiber light guiding and wave propagation characteristics, materials properties, optical transmitters, receivers and amplifiers, communications systems and fiber optics networks and the Internet. PCE II builds upon this knowledge with advanced subjects in system modeling, device integration, and systems-level engineering. Reference material for the course is in a digital platform to allow dense hyper-linking between topics so that students from various disciplines can customize the reading material to their individual background knowledge.

Prerequisites: OPTI 500A, B and C

Grading Policy:

Section E Exam (covering Modules 6-10) will determine the Course Grade in 500 II E.

Each Module will have 3 exam questions of which students select 2 questions to answer (or complete all questions and 2 highest scores are chosen by the instructor). All questions are weighted equally towards the Course Grade.

The grade will be determined according to the percentage earned such that 90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, below 60% = E.

See [Office of the Registrar website](#) for courses within a semester with different start and end dates.

Outline:

Module 6: Materials for Fiber Optics

- Optical, chemical, and mechanical requirements
- Fiber fabrication and drawing techniques
- Organic and inorganic cable materials
- Characterizing loss due to coupling/slicing

Module 7: Semiconductor Detectors

- Junction Properties
- Detector Characterization
- Noise Properties

Module 8: Transmitters

- Spectral Output of Semiconductors Lasers
- Contributions to the Rate Equations
- Neglect of Spontaneous Emission and Solutions to the Rate Equations
- Numerical Solutions and Multimode Operation

Module 9: Photonic Crystals

- Semiconductor quantum dot as a two-level system
- Dielectric photonic crystal cavities
- Light-matter coupling: controlled spontaneous emission (Purcell effect)
- Semiconductor cavity QED
- Applications of one or more quantum dots in a photonic crystal cavity
- Coupling a quantum dot to a metallic split-ring cavity

Module 10: Modeling Integrated Components & Design Tools

- Efficient computational techniques for EM fields in frequency and time domains
- EM field scattering and propagation in periodic structures
- Simulation of integrated circuits
- Analysis and design of multilayered printed circuit boards

Exam