OPTI 500A- Photonic Communications Engineering I A

Course Description:

Photonic Communications Engineering consists of two parts. Each course is further broken down into three sections: A, B and C. PCE I A covers optical fiber light guiding, wave propagation characteristics, materials properties, and fabrication. PCE I B covers optical transmitters, receivers and amplifiers. PCE I C covers communications systems, fiber optics networks, and Internet infrastructure. Sections A, B and C are each 1 credit and can be taken in any combination. When all three sections are taken together the course is designed as a survey, from the device to the systems level, of Photonic Communications Engineering. Reference material for the course is in a digital platform to allow dense hyperlinking between topics so that students from various disciplines can customize the reading material to their individual background knowledge.

Grading Policy:

Section A Exam (covering Module 1-5) will determine the Course Grade.

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 1: Communication Systems

- How email works
- How cell phone calls are transmitted through fiber cable
- Communication infrastructure: transmitters, detectors
- Multiplexing

Module 2: Materials and fabrication

- Optical, chemical, and mechanical material requirements
- Core/Cladding Geometry
- Preform Development

- Fiber drawing
- Fiber cables

Module 3: Attenuation in optical fibers

- Loss due to scattering
- Loss due to absorption
- Loss due to defects and impurities
- Loss due to connectorization
- Bending losses

Module 4: Wave Propagation

- Maxwell's equations
- Field solutions with cylindrical boundary conditions
- TE, TM, HE, EH modes and cut off conditions
- Linearly polarized modes
- Single mode fibers
- Multi mode fibers
- Mode power distribution

Module 5: Dispersion

- Material dispersion
- Group-velocity dispersion
- Waveguide dispersion
- Higher-order dispersion
- Polarization mode dispersion
- Effects of dispersion on propagation
- Dispersion Mitigation

Exam