PHOTONICS - GRADUATE CERTIFICATE

While 20th-century technology was defined by the growth of electronics, the field of photonics is coming of age in the 21st century. LEDs are lighting households powered by photovoltaic panels and connected to the internet via optical fiber. Holographic displays and virtual reality glasses are providing new forms of visualization. New microscopes are peering into living cells with resolutions that break previous limits. Photons are being used to interrogate atoms for quantum computations. Photonics graduates will command skills in theory, design, fabrication and laboratory practice to place them at the forefront of these industries and many more not yet invented.

Photonics is the electrical engineering sub-discipline concerned with the generation, modulation, radiative or guided transmission, sensing and detection of optical-frequency signals. Application areas include optical telecommunications and instrumentation, optical computing and data transmission, medical imaging, renewable energy, and environmental sensing. While some of these industries are mature, photonics continues to rapidly grow into emerging technologies such as quantum computing and cryptography, optogenetics, and virtual reality.

Photonics courses at CU Boulder engage high-caliber students from around the world. The courses typically run at a fast pace, often involving a mixture of fundamental theory, design in relevant industry standard CAD tools and individual projects.

For more information visit the department website (https://www.colorado.edu/ecee/graduate-program/degrees/photonics/).

MS-EE Certificate Overview

For scalability and streamlining administration, admission to the MS-EE degree is based solely on performance and requires a grade of B (3.0) or higher in a designated Pathway specialization. There is no graduate application. The degree may be earned by completing 30 credits with an overall 3.0 cumulative GPA or higher paying tuition along the way (i.e. $667/credit).

Similarly, a certificate may be earned by completing the designated courses in the certificate with an overall 3.0 cumulative GPA or higher. Prerequisite knowledge and other related courses are recommended as appropriate. Transfer credit into certificates or the MS-EE degree is not permitted.

This performance-based admissions method is fully approved by our Graduate School and the Office of the Registrar.

*NOTE: Typically, a minimum grade of C or higher in each course also apply, however, that aspect is under consideration at the campus level with respect to the MS-EE degree, and subsequently for the underlying certificates. The MS-EE and certificate MOOC courses are much smaller curriculum elements (about one month of content vs. a semester for a traditional campus course), so scalability and practicality for student progress are at issue. As mentioned above, policy decisions related to minimum grades and GPA tracking for the MS-EE degree will apply to the certificates proposed here.

Admission to a graduate degree-seeking program in the ECEE department is not required for students pursuing the certificate. Certificate credit hours may be applied towards a full master's degree, provided the student is admitted to the electrical engineering graduate program as a degree-seeking student.

Required Courses

The previously approved Semiconductor Photonics Certificate is comprised of 3 specializations, each of which is comprised of 3-4 individual online courses (i.e. MOOCs), which deliver about one month of content:

- Semiconductor Devices Specialization (3 credits, Pathway)
  - ECEA 5630 Semiconductor Physics (1 credit)
  - ECEA 5631 Diodes p-n and Schottky (1 credit)
  - ECEA 5632 Transistors FET and BJT (1 credit)
- Active Optical Devices Specialization (3 credits)
  - ECEA 5605 LEDs and Semiconductor Lasers (1.2 credits)
  - ECEA 5606 Nanophotonics and Detectors (1.2 credits)
  - ECEA 5607 Displays (0.6 credits)
- Photovoltaics Specialization (3 credits)
  - ECEA 5635 Fundamentals of Photovoltaics (0.6 credits)
  - ECEA 5636 Physics of Photovoltaic Devices (0.8 credits)
  - ECEA 5637 Modeling of Photovoltaic Devices (0.8 credits)
  - ECEA 5638 Photovoltaic Materials and Devices (0.8 credits)

The newly proposed modified Semiconductor Photonics Certificate replaces the Photovoltaics Specialization with the Optical Engineering Specialization:

- Optical Engineering Specialization (3 credits, Pathway)
  - ECEA 5600 First Order Optical System Design (1 credit)
  - ECEA 5601 Optical Efficiency and Resolution (1 credit)
  - ECEA 5602 Design of High-Performance Optical Systems (1 credit)

Further details regarding Photonics content under our online MS-EE degree through Coursera may be found here: https://www.colorado.edu/ecee/academics/online-programs/ms-ee-coursera/curriculum/photonics-and-optics