ECE 3225: Optical Engineering Laboratory

Credits and contact hours: 3 Credits (One 3-hour laboratory per week)

Instructor: Eric Donkor

Textbook: Projects in Fiber Optics, Newport, 1986

a. *Other supplemental materials* : Instructor's handouts

***Specific course information*:**

a. *Catalog Description*: Hands-on design and measurement of optical systems and components. Lens systems and imaging, fiber-optic communication and fiber-optic sensors, diffraction and Fourier Optics, interferometry, etc. Structured experiments and design projects centered on available equipment.

b. *Prerequisite*: ECE 3223

c. *Required, elective, or selected elective:* Selected Elective (EE)

***Specific goals for the course*:**

a. *Specific outcomes of instruction*:

- This course gives students hands-on experience in operating basic optical instruments such as optical spectrum analyzers, power meters, spectrometers, fiber cleavers etc

- Learn to design practical optical circuits and systems using optical components including lasers, beam splitters/combiners, photodetectors, fiber couplers, gratings etc,

- Design experiments and perform experimental measurements in Fourier-optics, laser optics, diffractive optics. with applications to optical communication, sensors, image processing, and spectroscopy

b. *ABET Criterion 3: Student Outcomes addressed by the course*:

1. **an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics**
   There are many practical problems under each topic to be investigated experimentally by the students utilizing what they have learned from the lectures in EE 3223 (prerequisite).

2. **an ability to apply engineering design to produce solutions that meet specified needs with considerations of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**

Students learn about modern sensor systems and fiber-optics diagnostics methods and value of such systems in solving specific needs in society.

3. **an ability to communicate effectively with a range of audience**
   Students learn to communicate through several in-lab group discussions, and post-lab written reports.

4. **An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts**
   n/a

5. **an ability to function effectively on a team whose members together provide leaderships, create a collaborative and inclusive environment, establish goals, plan task, and meet objectives**
   Students work together in teams. This requires pre-lab and post-lab group meetings, and in-lab division of tasks and responsibilities to meet project goals.

6. **an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusion**
   Students perform experiments and compare and contrast experimental results with theory. They also design experiments to solve specific engineering problems in laser optics, diffractive optics, and fiber optics.

7. **an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**
   Student use online electronic media, and library resources to obtain information and data for pre-lab activities.

Topics covered:

- Single- and multi-mode fiber characterization.
- Fiber optic communication components (sources, detectors, modulators, WDM)
- Implementation and loss-budget measurement of a two-channel fiber-optic link
- Fiber optic sensor experiments
- Polarization of light
- Michelson interferometry
- Free-space two-channel optical communication link
- Light diffraction and diffraction grating experiments
- Holography and optical image processing
- Optical time-domain reflectometry