Course Topics:

This course exposes students to a broad array of topics in optics, with an emphasis on understanding over-arching concepts, general physical principles that dictate the behavior of light, as well as practical knowledge about common optical components and devices, and analytical tools for engineering simple optical systems. Topics covered in the course: ray optics, wave optics, Gaussian optics, Fourier optics, interferometry, and polarization optics.

Course Learning Objectives:

By successfully completing this course, students will be able to:

- Demonstrate a correct solution to problems of Ray Optics with and without ABCD matrix.
- Analyze the interaction between elementary wave functions and simple optical elements.
- Understand optical interferometers and analyze their total intensity distribution.
- Analyze Gaussian beams and their physical properties through arbitrary optical systems using ABCD matrix.
- Apply Fourier description to the light propagation.
- Demonstrate light as an electromagnetic field that satisfies the Maxwell equations.
- Analyze absorption and dispersion in a medium, and their relationship with the refractive index.
- Analyze the polarization state of the light through several elements by applying the Jones matrix.

Course Outcomes:

Students successfully completing this course will be able to:

1. Calculate the reflection and refraction angle in a planar interface between two different media.
2. Determine the image height and position of an optical system composed of one or two lenses.
3. Calculate the ABCD matrix of an arbitrary optical system.
4. Determine the condition in which a spherical wave can be described by a paraboloidal wave.
5. Determine the Fourier plane of an optical imaging system.
6. Determine a *4f* imaging system.
7. Determine the polarization state of the light through several polarization-sensitive elements.