# Course Outline

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| **Course title: Introduction to Optic-Electrical Engineering** | **Instructor name: Jun Albert Pardillo** |
| **Credit units: 3** | **Total hours: 54** |

## Course Description:

Introduction to Optic-Electrical Engineering is a course designed for 3rd Year Electrical Engineering students who are interested in exploring the intersection of optics and electrical engineering. This course will provide students with a comprehensive understanding of the principles and applications of optic-electrical engineering.  
  
The course will begin with an introduction to the fundamental concepts of optics, including light propagation, reflection, refraction, and diffraction. Students will then learn about the properties of optical materials and devices, such as lenses, mirrors, and prisms, and how they can be used to manipulate light.  
  
Next, the course will cover the basics of electrical engineering, including circuit analysis, signal processing, and power systems. Students will learn how to apply these concepts to the design and analysis of optical-electrical systems, such as fiber optic communication networks, photovoltaic cells, and laser systems.  
  
Throughout the course, students will engage in hands-on activities and projects to reinforce their understanding of the material. They will also have the opportunity to work with state-of-the-art equipment and software, including optical simulators, oscilloscopes, and signal generators.  
  
By the end of the course, students will have a deep understanding of the principles and applications of optic-electrical engineering, and will be well-prepared to pursue advanced studies in this exciting field.

## Course Learning Outcomes (CLOs)

* Understand the fundamental concepts of optics, including light propagation, reflection, refraction, and diffraction.
* Gain knowledge of the properties and applications of optical materials and devices.
* Learn the basics of electrical engineering as they apply to optic-electrical systems.
* Develop skills in designing and analyzing optic-electrical systems, including fiber optic communication networks, photovoltaic cells, and laser systems.
* Engage in hands-on activities and projects using state-of-the-art equipment and software to reinforce understanding of optic-electrical engineering principles.

## Topics / Modules and Intended Learning Outcomes

1. Fundamentals of Optics

* Explain the principles of light propagation, reflection, refraction, and diffraction.
* Analyze simple optical systems using geometric optics principles.

1. Optical Materials and Devices

* Describe the properties of optical materials, including refractive index and dispersion.
* Understand the functioning and applications of lenses, mirrors, and prisms in optical systems.

1. Basics of Electrical Engineering for Optic-Electrical Systems

* Apply circuit analysis techniques to simple electrical circuits.
* Understand the basics of signal processing and how it applies to optic-electrical systems.

1. Fiber Optic Communication Networks

* Describe the principles of fiber optic communication and the types of fibers used.
* Design a basic fiber optic communication system, including source, transmitter, fiber, and receiver.

1. Photovoltaic Cells and Laser Systems

* Explain the working principles of photovoltaic cells and their applications in energy systems.
* Understand the basics of laser operation, types of lasers, and their applications in engineering.

## Weekly Activities

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| **Week No.** | **Topic** | **Activity Description** | **Expected Output** | **Assessment Tools** |
| Week 1 | **Fundamentals of Optics** | Introduction to the course and basic concepts of optics. Lecture on light propagation and its principles. | Students will be able to identify and explain the principles of light propagation. | Quiz and class participation |
| Week 2 | **Fundamentals of Optics** | Lecture and laboratory on reflection, refraction, and diffraction including hands-on experiments. | Students will perform basic optical experiments demonstrating reflection, refraction, and diffraction. | Lab report and practical examination |
| Week 3 | **Optical Materials and Devices** | Introduction to optical materials and their properties. Lecture on refractive index and dispersion. | Students will understand the properties of optical materials and their impact on light propagation. | Homework assignments and quiz |
| Week 4 | **Optical Materials and Devices** | Lecture and demonstration on lenses, mirrors, and prisms. Students will learn about their applications in optical systems. | Students will be able to describe the functioning of lenses, mirrors, and prisms. | Class presentation and written examination |
| Week 5-6 | **Basics of Electrical Engineering for Optic-Electrical Systems** | Lectures on circuit analysis and signal processing fundamentals. Introduction to their applications in optic-electrical systems. | Students will apply circuit analysis techniques and understand signal processing basics. | Quiz and project proposal |
| Week 7-8 | **Fiber Optic Communication Networks** | Comprehensive lectures on fiber optic communication principles and system design. Includes a workshop on designing a basic fiber optic communication system. | Design of a simple fiber optic communication system. | Project design review and peer evaluation |
| Week 9-10 | **Photovoltaic Cells and Laser Systems** | Lectures on the principles of photovoltaic cells and laser operation. Includes a lab session on laser systems. | Understanding of photovoltaic cells and laser operation principles. Lab report on laser systems. | Lab report and quiz |
| Week 11-18 | **Project and Review** | Students will engage in a comprehensive project that encompasses the design and analysis of an optic-electrical system. Final weeks are dedicated to project completion, presentations, and course review. | A complete project report and presentation on the designed optic-electrical system. | Project report, presentation, and final examination |

## References

*Hecht, E. (2016). Optics (5th ed.). Pearson Education.*  
Link:

*Saleh, B. E. A., & Teich, M. C. (2019). Fundamentals of Photonics (3rd ed.). Wiley.*  
Link:

*Alexander, C., & Sadiku, M. (2013). Fundamentals of Electric Circuits (5th ed.). McGraw-Hill Education.*  
Link:

*Agrawal, G. P. (2012). Fiber-Optic Communication Systems (4th ed.). Wiley.*  
Link:

*Green, M. A. (2012). Solar Cells: Operating Principles, Technology, and System Applications. Prentice-Hall.*  
Link: