Puerto Rico Photonics Institute
UNIVERSIDAD METROPOLITANA

LABORATORY CONTENT

CERTIFICATE IN PHOTONICS & LASERS TECHNICAL SPECIALIST

OPSC 101 – FUNDAMENTALS OF LIGHT AND LASERS

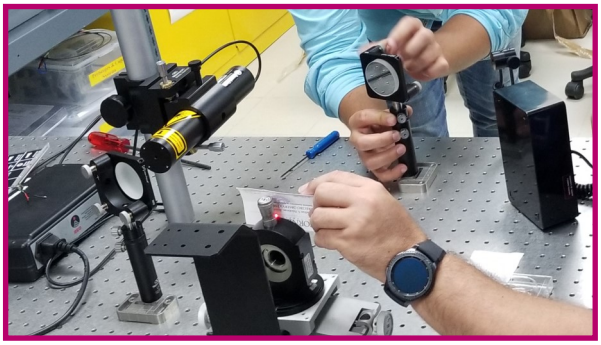
This Optical Science course introduces the student to the basic physical concepts and lab techniques that will be required for the technical courses of the certificate program in Photonics and Lasers. This combines a lecture component and hands-on laboratories that provide the students with learning opportunities to build their technical skills in working with lasers and optical components. These skills have direct practical application in the areas of optics, lasers, photonics, and in fields such as biomedical equipment, manufacturing, defense, nanotechnology, and communications where photonics is an enabling technology.

Nature and Properties of Light

Students begin their exploration into photonics and lasers by learning of the nature and properties of light. Concepts include propagation, illumination, scattering, reflection and refraction, color and spectrum, wave and particle properties, and polarization. They also learn the basics of coherence and phase. The course covers transparent materials, critical angle and total-internal reflection, Brewster angle, diffraction, interference, absorption and emission, including how atoms interact with light. There is discussion of Black-body emission, Mie and Rayleigh scattering, diffuse scattering, dispersion, and laser safety, and it presents applications of many of these principles.

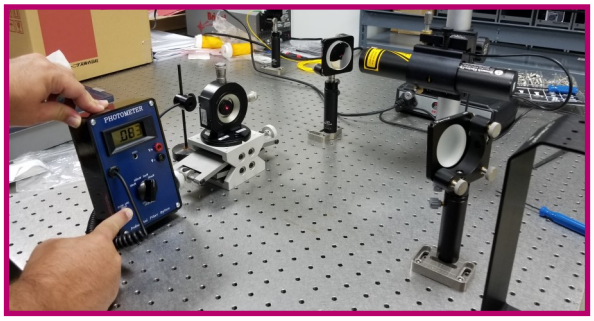
Basic Geometrical and Physical Optics

This module extends the discussion of reflection and refraction to help students develop a geometrical view of light. Wavefront and ray propagation, reflection and diffuse scatter lead to a discussion of image formation. Behavior of light at an interface is presented, and topics of critical angle and dispersion are covered in greater detail. Formation of real and virtual images is covered through the learning of ray-tracing methods. This is then applied to systems of one and two lenses and mirrors. Application of these principles to imaging technologies is also discussed.



HeNe Laser and Alignment

HeNe Laser - Optical Handling and Positioning



HeNe Laser - Basic Geometrical and Physical Optics

Light Sources and Laser Safety

After describing the difference between laser and non-laser light sources, we explore laser safety, beginning with eye and skin anatomy and hazards. Laser safety classifications are presented, using the ANSI Z136.1 standards. Safety controls are covered, including personal and area safety. Then we move on to describing "Maximum Permissible Exposure" (MPE) and "Nominal Hazard Zone" (NHZ) concepts. Following those, we talk about material absorption properties, with focus on materials for laser safety. Thus, absorption and neutral density are covered. We finish covering safety labeling, laser accidents, and summarizing safety rules.

Optical Materials, Handling and Positioning

Materials, especially durable transparent and polished materials are vital to photonics. Students learn here about materials properties, not only optical but physical, chemical and environmental. Both dielectric (transparent) and metallic (reflecting) materials are considered. Optical coatings are introduced and coating systems and testing described. Applications of optical coatings and materials are presented.

Next, we talk about optics mounting and positioning hardware, its designs and usage. Finally, we cover optical surfaces, damage, cleaning and storage.

This program is offered at the UMET Cupey campus, with laboratories at the PRPI labs in Barceloneta
Project New Horizons: Puerto Rico Lasers and Photonics Career Pathways
http://umet.suagm.edu/prpi | http://umet.suagm.edu/new_horizons

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