Course Objectives/Course Outline
Spokane Community College

Course Title: Photonics I
Prefix and Course Number: ELECT 235

Course Learning Outcomes:
By the end of this course, a student should be able to:

- Describe the properties of light
- Handle optical elements
- Describe the relationship between light rays and wave fronts
- Safely operate lasers
- Describe the properties of basic types of optics
- Explain how light is polarized
- Differentiate between spontaneous and stimulated radiation
- Explain the mechanism of coherent light generation

Course Outline:

I. Properties of Light

A. Wavelength, Frequency, Speed, Period, Amplitude, Energy
B. Phase, Coherence, and Polarization
C. Wave vs Particle
D. Electromagnetic spectrum
E. Reflection and Refraction
F. Diffraction and Interference.
G. Light sources
H. Scattering, absorption, and transmission
I. Safety procedures

II. Optical Handling and Positioning

A. Optical materials
B. Thermal, mechanical, and chemical properties
C. Anti-reflection coatings and filters
D. Mountings
E. Translational and rotational stages
F. Inspection, cleaning, and storage

III. Laser and Photonics Safety

A. Monochromaticity, directionality, and coherence
B. Non-beam hazards
C. Human eye hazards
D. Laser classifications
E. Maximum permissible exposure
F. Laser hazard controls and warning signs
G. Safety precautions

IV. Basic Optical Principles and Devices

A. Light rays and light waves
B. Law of reflection and Snell's law of refraction
C. Index of refraction
D. Total internal reflection
E. Gaussian or paraxial optics
F. Collimated light and the focal points
G. Ray-tracing techniques
H. Thin lens and thick lens
I. Focal length of a thin lens
J. Light rays and wave fronts
K. Phase angle
L. Superposition
M. Huygens' principle
N. Constructive and destructive interference
O. Fraunhofer (far-field) and Fresnel (near-field) diffraction
P. Diffraction-limited optics
Q. Brewster's angle

V. Principles of Lasers

A. Spontaneous and stimulated radiation
B. Energy level diagrams
C. Coherent light generation
D. Gain in a laser
E. Longitudinal modes and mode separation
F. TEM modes
G. Laser cavity configurations and losses
H. Laser beam properties
I. Types of lasers

Material Covered:

- Properties of Light
- Optical Handling and Positioning
- Laser and Photonics Safety
- Basic Optical Principles and Devices
- Principles of Lasers