

OP-TEC

National Center for Optics and Photonics Education



NSF/ATE
National Center
of Excellence

2008

OP-TEC PHOTONICS CURRICULUM MATERIALS

Leading the Development of
Photonics Technicians in U.S.
Community and Technical Colleges



LASER ELECTRO-OPTICS TECHNOLOGY Series

Equip Your Students for Technical Careers in Lasers!

Prepares students for employment as laser/electro-optics technicians, or prepares technicians for advanced technical training. Basic computational mathematics, algebra, geometry, and trigonometry are prerequisites.

- **Modular approach enables flexibility and adaptation**
- **Contains measurable, performance-based objectives with hands-on lab experiments**



Introduction to Lasers

LE019-4

\$52.50 (Bookstore price \$42.00)

- Elements and Operation of a Laser
- Elements and Operation of an Optical Power Meter
- Introduction to Laser Safety
- Properties of Light
- Emission and Absorption of Light
- Lasing Action
- Optical Cavities of Modes of Oscillation
- Temporal Characteristics of Lasers
- Spatial Characteristics of Lasers
- Helium-Neon Gas Laser: A Case Study

Laser Technology

LE021-6

\$55.00 (Bookstore price \$44.00)

- Power Sources for CW Laser
- Pulsed Laser Flashlamps and Power Supplies
- Energy Transfer in Solid-State Lasers
- CW Nd:YAG Laser Systems
- Pulsed Solid-State Laser Systems
- Energy Transfer in Ion Laser
- Argon Ion Laser Systems
- Energy Transfer in Molecular Lasers
- CO₂ Laser Systems
- Liquid Dye Lasers
- Semiconductor Lasers
- Measurement of Laser Outputs
- Laser Safety: Hazards Evaluation

Geometric Optics

LE020-8

\$41.25 (Bookstore price \$33.00)

Revised and Updated!

- Reflection at Plane and Spherical Surfaces
- Refraction at Plane Surfaces
- Refraction at Spherical Surfaces
- Imaging with a Single Lens
- Imaging with a Multiple Lens
- F-Stops and Apertures
- Optical Systems
- Matrix Optics
- Fundamentals of Fiber Optics



Light Sources and Wave Optics

LE023-2

\$52.50 (Bookstore price \$42.00)

- Light Sources and Characteristics
- Radiometry and Photometry
- Wave Nature of Light
- Reflection and Refraction
- Propagation
- Interference
- Diffraction
- Polarization
- Holography

LASER ELECTRO-OPTICS TECHNOLOGY Series

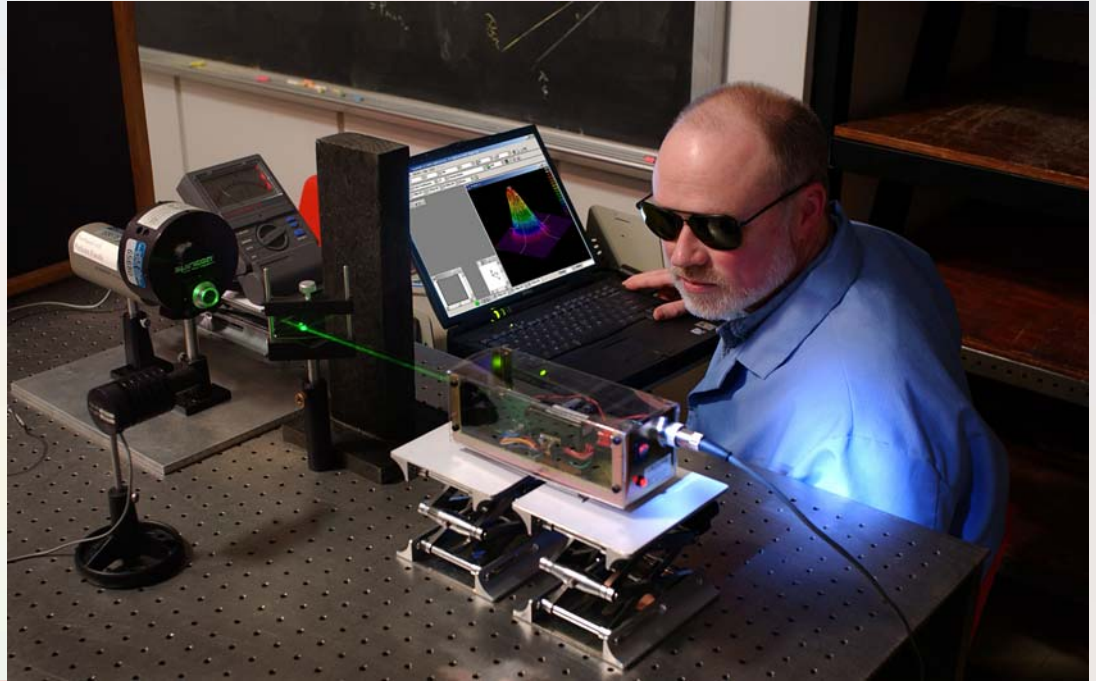
Laser/Electro-Optic Measurements

LE053-4

\$41.25 (Bookstore price

\$33.00)

- Spectrometers & Spectrophotometers
- Monochromators
- Michelson, Fabry-Perot, Twyman-Green, & Mach-Zehnder Interferometers
- Spatial Resolution of Optical Systems



Laser & Electro-Optic Components

LE024-0

\$61.25 (Bookstore price \$49.00)

- Optical Tables and Benches
- Component Supports
- Photographic Recording Mediums
- Windows
- Mirrors and Etalons
- Filters and Beam Splitters
- Prisms
- Lenses
- Gratings
- Polarizers
- Nonlinear Materials

Laser Electronics

LE578-1

\$61.25 (Bookstore price \$49.00)

- Electrical Safety
- Gas Laser Power Supplies
- Ion Laser Power Supplies
- Flashlamps for Pulsed Laser & Flashlamp
- Arc Lamp Power Supplies
- Laser Diode Power Supplies
- Electro-Optic Acousto-Optics Devices
- Optical Detectors
- Electro-Optic Instrumentation

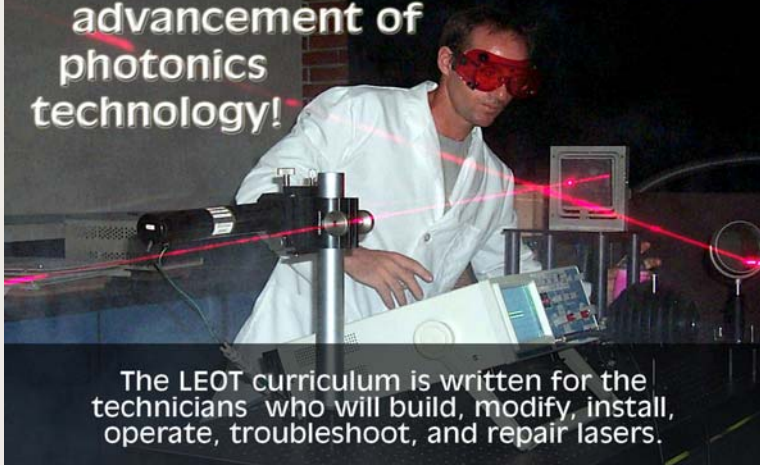
Laser/Electro-Optic Devices

LE050-X

\$61.25 (Bookstore price \$49.00)

- Photodetector Characteristics
- Photodetector Types
- Laser Power and Energy Detectors
- Photoinstrumentation Equipment
- Holographic Techniques, Equipment
- Collimators and Autocollimators Beam Expanders and Spatial Filters
- Isolators
- Electro-Optic Modulators
- Acousto-Optic Devices
- Mode-Locking

Technicians are a vital link in the advancement of photonics technology!



The LEOT curriculum is written for the technicians who will build, modify, install, operate, troubleshoot, and repair lasers.

LASER, OPTICS and PHOTONICS Series



OP-TEC Photonics Curriculum Materials

There is an increasing need for technicians that have knowledge and skills in lasers, optics, and fiber-optics. Two-year colleges are viewed as the primary institution nationally that can provide a solution to this problem by infusing optics and photonics technology as part of existing two-year applied technology degree programs.

Photonics (lasers, optics, LED's and fiber optics) is an emerging technology that also enables "next generation" developments in areas such as telecommunications, manufacturing, nanotechnology, environmental science, homeland security, and biomedicine. OP-TEC has developed text/laboratory materials to support education and training for future and current technicians for applying photonics in these areas.

Course 1, *Fundamentals of Light and Lasers*, is a comprehensive study of photonics that was specifically written for AAS students enrolled in enabling technology programs or for employed technicians working in

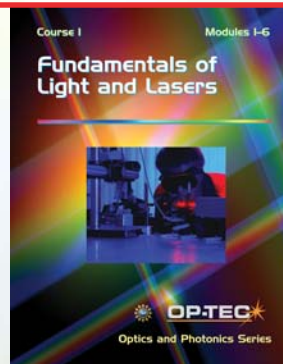
these same areas. Course 2 deals with specific photonics systems and applies the principles presented in Course 1. Additionally, the last three modules in Course 2 can be replaced with those in the Photonics Enabled Technology (PET) Series to customize this course for the enabling areas presented above.

To date, CORD has developed content and support materials for the first two courses, in addition to stand-alone modules relating to Photonics-Enabled Technologies (PET Series).

Course 1: Fundamentals of Light and Lasers

PH0502-9 \$75.00
(Bookstore price \$60.00)

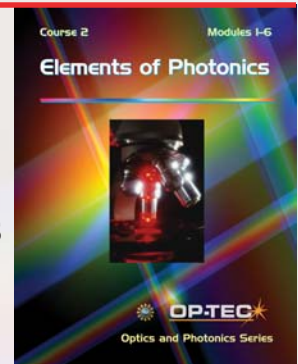
- Nature and Properties of Light
- Optical Handling and Positioning
- Laser Safety
- Basic Geometrical Optics
- Basic Physical Optics
- Principles of Lasers



Course 2: Elements of Photonics

PH0378-6 \$75.00
(Bookstore price \$60.00)

- Operational Characteristics of Lasers
- Specific Laser Types
- Optical Detectors & Human Vision
- Principles of Optical Fiber Communications
- Photonics Devices for Imaging, Storage & Display
- Basic Principles & Applications of Holography



The National Photonics Skill Standards for Technicians - 3rd Edition

Available for free download at <http://www.op-tec.org/Skill.php>

The National Photonics Skill Standards for Technicians represents the consensus of a broad cross-section of U.S. employers regarding the technical and workplace skills required of photonics technicians. It's designed to give educators the foundation for generating courses and programs that will enable U.S. two-year colleges (and their feeder high schools) to produce globally competitive workers. The standards provide "critical works functions" and typical tasks for six photonics-enabled technologies: communication, lighting and illumination, medicine, manufacturing, optoelectronics, and imaging and remote sensing. This edition includes new standards-based curricula including a 4+2 AAS photonics curriculum, two models for infusing photonics concepts into AAS programs, and an advanced certificate curriculum to enhance the skills of technicians already employed in photonics-enabled technologies.

LASER, OPTICS and PHOTONICS Series

Modules in Photonics Enabled Technologies

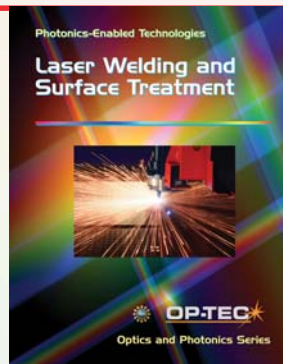
Photonics involves cutting-edge uses of lasers, optics, fiber-optics, and electro-optical devices in numerous and diverse fields of technology—manufacturing, health care, telecommunications, environmental monitoring, homeland security, aerospace, and many others. The applications of photonics as an “enabling” technology are extremely broad.

The following are 14 stand-alone modules to prepare students for careers in specific photonics enabled technologies.

\$14.95 each (Bookstore price \$11.95)

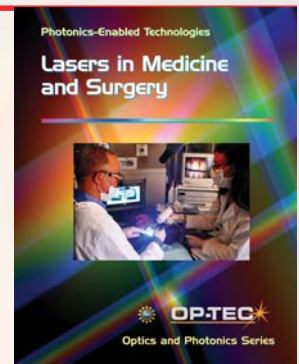
Modules in Manufacturing

- Laser Welding & Surface Treatment—PH0395-6
- Laser Material Removal: Drilling, Cutting, & Marking—PH0396-4
- Lasers in Testing & Measurement: Alignment, Profiling and Position Sensing—PH0397-2
- Lasers in Testing: Interferometric Methods and Nondestructive Testing—PH0398-0



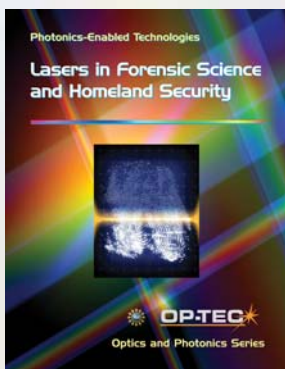
Modules in Biomedicine

- Lasers in Medicine & Surgery—PH0399-9
- Therapeutic Applications of Lasers—PH0490-1
- Diagnostic Applications of Lasers—PH0491-2



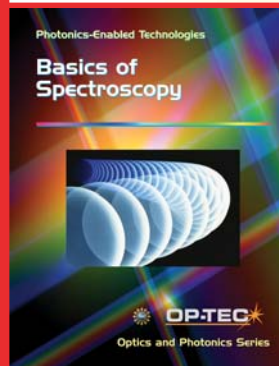
Modules in Forensic Science and Homeland Security

- Lasers in Forensic Science & Homeland Security—PH0400-6
- Infrared Systems for Homeland Security—PH0486-3
- Imaging System Performance for Homeland Security Applications—PH0487-1



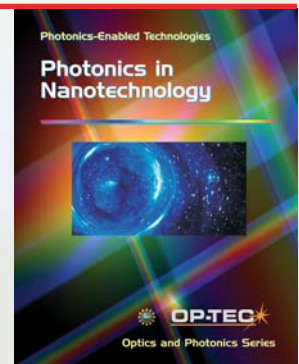
Modules in Environmental Monitoring

- Basics of Spectroscopy—PH0424-3
- Spectroscopy & Remote Sensing—PH0493-6
- Spectroscopy & Pollution Monitoring—PH0492-8



Modules in Optoelectronics

- Photonics in Nanotechnology—PH0485-5
- *Coming Soon!* Photonics in Nanotechnology Measurements: A Study of Atomic Force Microscopy
- *Coming Soon!* Photonic Principles in Photovoltaic Cell Technology



“Optics is rapidly becoming an important focus for new businesses in the global economy.”

-Harnessing Light: Optical Science and Engineering for the 21st Century, National Research Council

LASER, OPTICS and PHOTONICS Series

Program Planning Guides

For infusing Photonics Education into Photonics Enabled Technologies

These complimentary Program Planning Guides are manuals for community/technical college planners (technical program chairs, deans and faculty) to enable them to determine whether and how to include photonics education in existing programs. Each Guide addresses the following topics:

- Skill Standards for Photonics Technicians
- Strategies for implementation
- Course designs
- Available student and instructor materials
- Lab and equipment overview
- Criteria for selecting faculty/Training
- Recruitment strategies



To order a **COMPLIMENTARY COPY** of any of the Program Planning Guides, please e-mail your request to op-tec@cord.org or call 254-741-8338 x394. Please include the name(s) of the requested Program Planning Guide and catalog number in your request.

*Infusing Photonics Education Into **Manufacturing Technology** AAS Programs—PHO481-2*

Greg Kepner, Bill Gray & Frank Reed—Indian Hills Community College; Dan Hull—OP-TEC

*Infusing **Biomedical Applications** of Photonics Into Electronics Engineering Technology Programs—PHO483-9*

Chrys Panayiotou—Indian River State College; Dan Hull—OP-TEC

*Infusing **Homeland Security** Photonics Education Into Electronics Engineering Technology—PHO489-8*

Chrys Panayiotou—Indian River State College; Dan Hull—OP-TEC

*Infusing Photonics Education Into **Optoelectronics** AAS Programs (Semiconductors, MEMS and Nanotechnology)—PHO484-7*

John Pedrotti—Texas State Technical College Waco; Dan Hull—OP-TEC

*Infusing Photonics Education Into **Telecommunication Technology** AAS Programs—PHO488-X*

Fred Seeber & Raman Kolluri—Camden County College; Dan Hull—OP-TEC

*Program Planning Guide Supplement: Infusing Photonics to Increase Enrollment in **Electronics Engineering Technology***

Available for free download at [http://www.op-tec.org/SAME-TEC%20Paper-FFV%20\(NCPN%20handout\).pdf](http://www.op-tec.org/SAME-TEC%20Paper-FFV%20(NCPN%20handout).pdf)
Chrys Panayiotou, Indian River State College

Coming Soon!

*Infusing Laser & Optics Education for **High School** Students*

*Infusing Photonics into a Revitalized **Electronics** Core*

Mathematics for Photonics Education

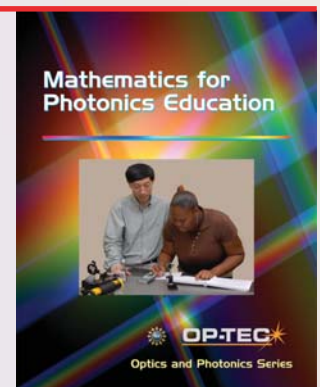
PHO352-2

Student Edition \$18.00
(Bookstore price \$14.90)

PHO354-9

Student Assessment and Answer Key \$10.00
(Bookstore price \$8.00)

- Scientific Notation & Unit Conversion
- Introductory Algebra/Geometry/Trig.
- Powers & Roots/Ratio & Proportion
- Exponents & Logarithms
- Graphing
- Angle Measures in Two & Three Dimensions



OP-TEC Services

The following services can be provided by OP-TEC through CORD and the Partner Colleges.

- Information about Photonics Technology and Technician Careers
- Technical Assistance in Program Feasibility and Planning
- Technical Assistance in Curriculum Design and Development
- Technical Assistance in Designing Laboratories
- Professional Development and Teacher Training



For more information contact:

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