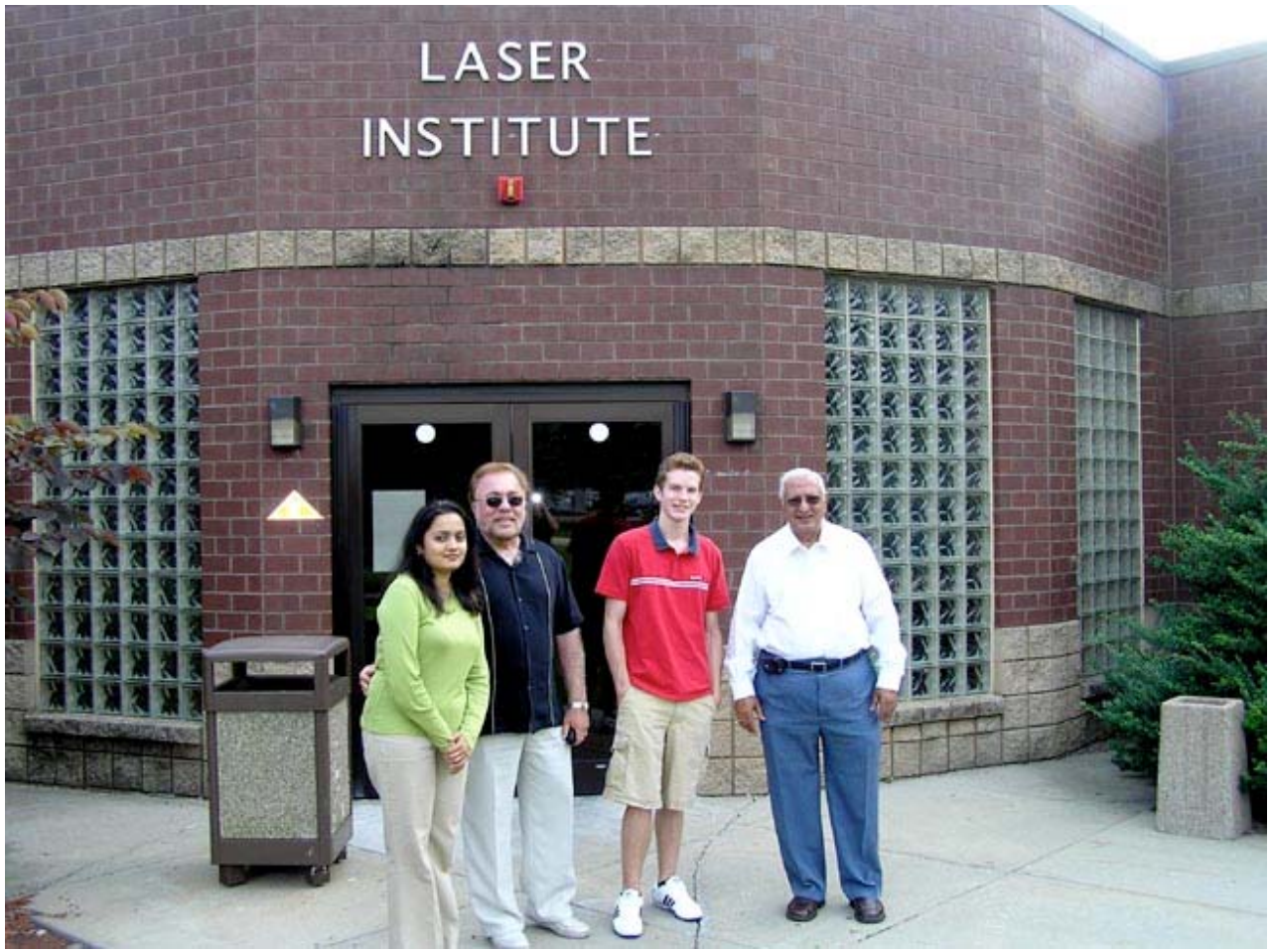
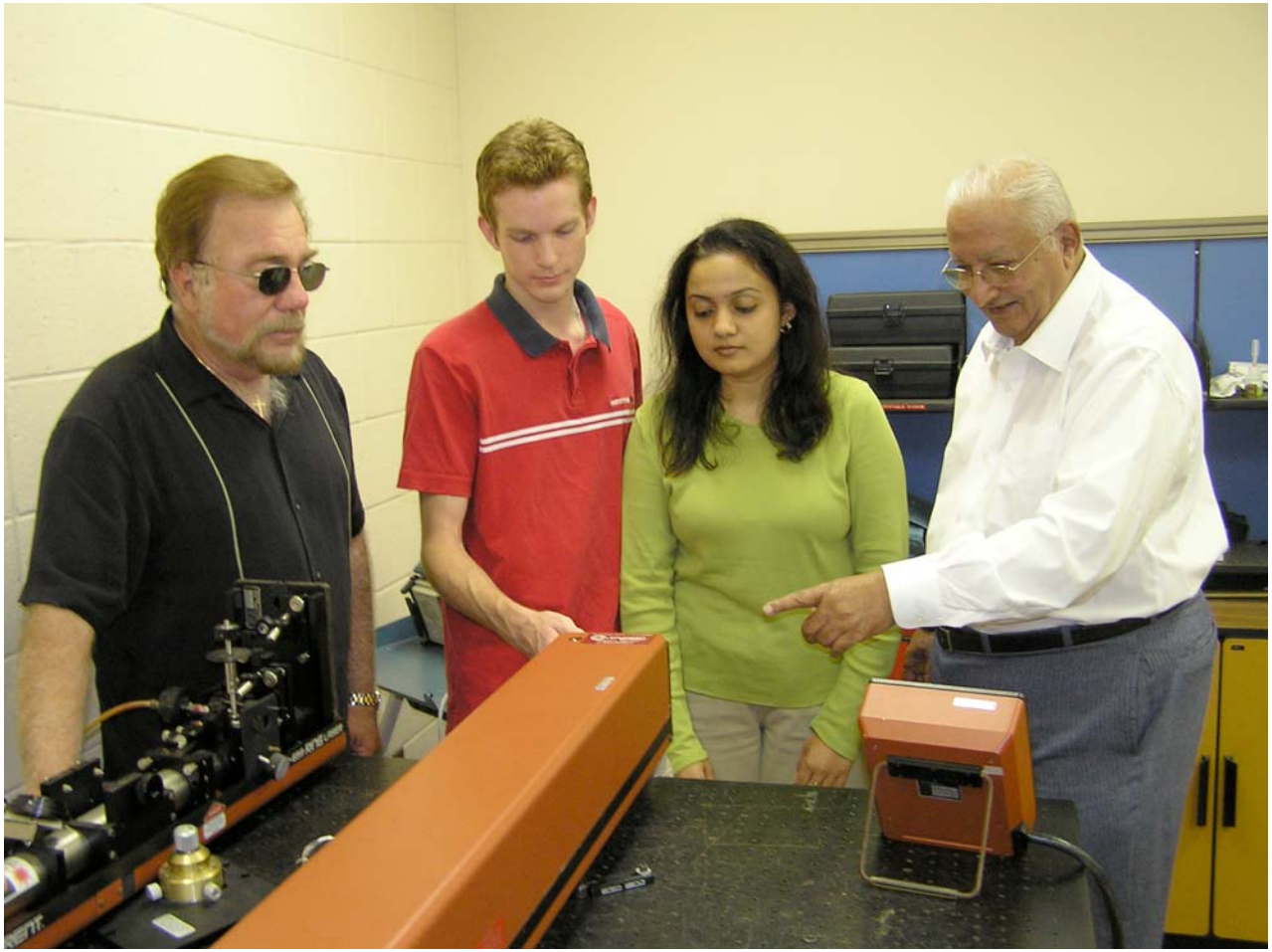
Photonics as an Enabling Technology in Telecommunications OP-TEC/ Camden County College

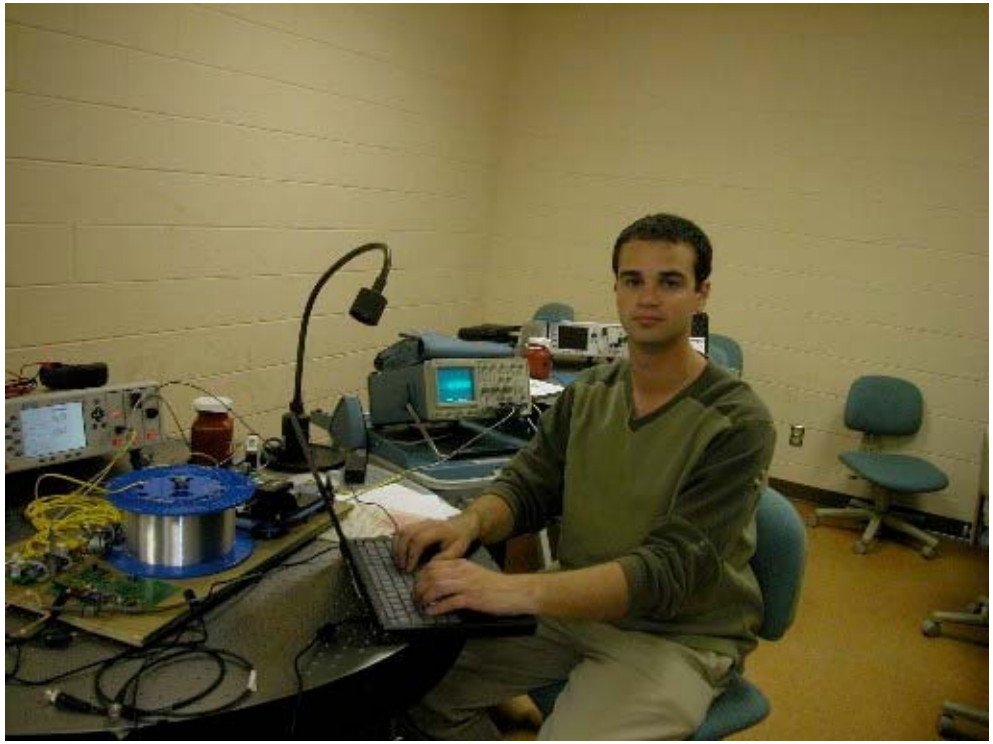
Laser Institute at Camden County College



Ion Laser



Fiber Optics Laboratory



The Laser Institute of Technology for Education and Research is a free standing, fully equipped facility at Camden County College with 16 laboratories for laser and fiber optics courses. This facility was built by the State of New Jersey in 1989.

CCC started its program in Photonics in 1976 and has graduated over 500 students who many are presidents of their own companies, engineers, and optical physicists

For OP-TEC, CCC will emphasize optical communications and laser safety by developing new materials and creating career pathways for middle school students through graduate school. We will also provide professional development in this area for teachers and professors around the country.

Middle School Pathway Program Rationale

The Camden County College Pathway Program is a partnership with a number of school districts. It is a comprehensive program designed to facilitate the career orientation and development of students in telecommunications. The program provides an opportunity for students to outline a seamless career pathway in an effort to bridge the gap between the middle grades, high school, and county colleges.

Middle School Pathway Program
Goal

The goal of the program is to provide students with learning activities in Photonics such as class projects, college field trips, career days, speakers, and demonstrations from business and industry. The grade levels are 6 through 8 and emphasizes a greater awareness of the college academic and technical program opportunities available at Camden County College.

Middle School Pathway Program Objectives

1. Demonstrate a positive attitude towards career clusters.
2. Discuss in class the telecommunications career.
3. Identify the career cluster and educational skills required.
4. Demonstrate competencies learned through hands-on activities.
5. Identify career pathway opportunities in the county and surrounding areas within their interests.
6. Relate their personal strengths within their career pathway.

1a. Suggested Framework for Optical Communications Technology Curriculum

Subject Area Grade	Language Arts	Mathematics	Science	Social Science/ Humanities	Health & Technical Courses	Career Major
Ninth Grade	English I	Intermediate Algebra	Chemistry/ B iology	U.S. History	Computer Keyboarding	Introduction to Technology
Tenth Grade	English II	Algebra I & Geometry	General Physics I (basic optics)	World History/ Government	Health/ P.E.	Engineering Principles
Eleventh Grade	English III	Algebra II & Trigon ometry	General Physics II (geometrical optics & instrumentation)	Foreign Language/ Humanities/ Social Science elective	Health/ P.E.	Computer Aided Design
Twelth Grade	English IV	Pre-calculus	General Physics III (physical optics)	Foreign Language/ Humaniti es/ Social Science elective	Electricity (A.C./ D.C.)	Machine Shop Practices
PS-1st semester	English Comp I	Algebra/ Trig or Calculus I	College Physics I or III	Humanities elective	Fundamentals of Light & Lasers	Basics Telecommunications
PS-2nd semester	English Comp II	Calculus II	College Physics II or IV	Health elective	Electro -Optic Principles	Photonic Materials
PS-3rd semester	Technical Report Writing	Photonic Principles & Components	Electronics for Photonics	Social science elective	Photonic Measur ements	Introduction to Fiber Optics
PS-4th semester	Speech Communication	Optical Detectors & Measurements	Advanced Fiber Optics	Digital Circuits	Fiber Optics elective	Fiber Optics Project

Middle School Pathway Program Logistics

The program may function best if integrated into the existing school curriculum for all sixth, seventh, and eighth grade students. A career pathway is presented as a unit of study for selected periods of time. Career cluster material should be integrated into the english, math, science, and social studies disciplines and coordinated by the guidance staff or lead teacher.

Middle School Pathway Program

Logistics (continued)

In order for the program to be successful, these major requirements are necessary:

1. School administration and boards must be committed to the program in order to provide the needed support for success.
2. A staff person from each partner school must be assigned to coordinate the program.
3. Teachers and guidance staff must be involved in the planning.
4. Parents, local business, and other interested parties must be kept informed.
5. An advisory group for each school should be formed.

Photonics Infusion for the High School in Telecommunications

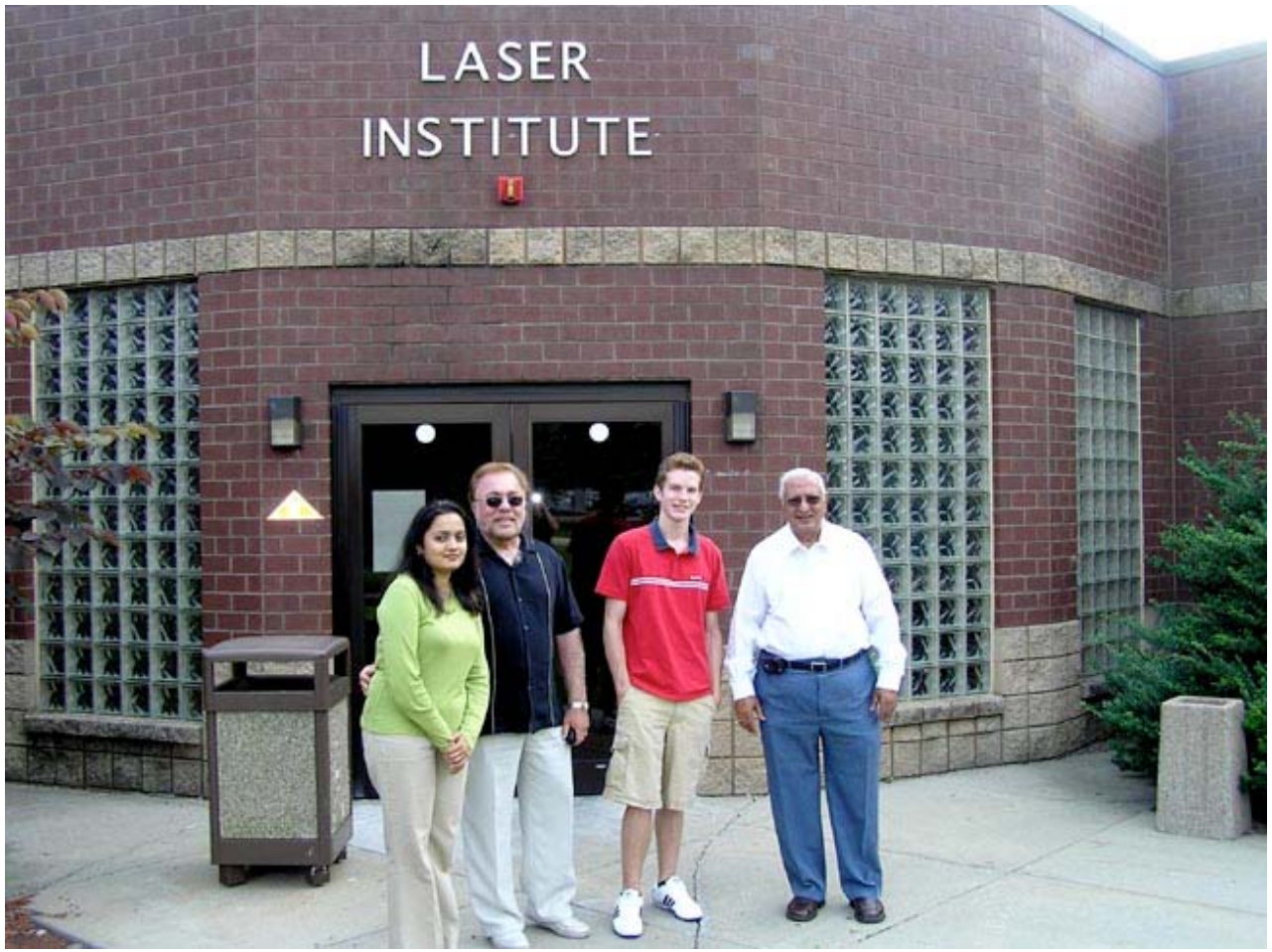
1. It is proposed to increase the optics content in high school physics without altering the course structure.
2. At least some amount of both geometrical and physical optics will be added to the existing curriculum of 11^{th} grade physics.
3. Basics of coherent radiation and principles of lasers and basics of propagation of light through fibers will be introduced in 12^{th} standard curriculum. They will form the basis for “Light and Principles of Lasers” which is the first course in photonics at the college.
4. A minimum of two semesters of fiber optics will be required for a graduate in communications.

Photonics Infusion (continued)

5. Additional electives and projects will be offered through the co-op program with industry.
6. Electronic circuits and solid state devices including detectors will be part of the curriculum.
7. The selection of telecommunications is based on the expertise and the equipment available in the department. The other motivation is the ever increasing demand for optical communications systems.

The Full Associate Degree Program – Laser Electro-Optics & Fiber Optics option at Camden County College

Laser Institute at Camden County College

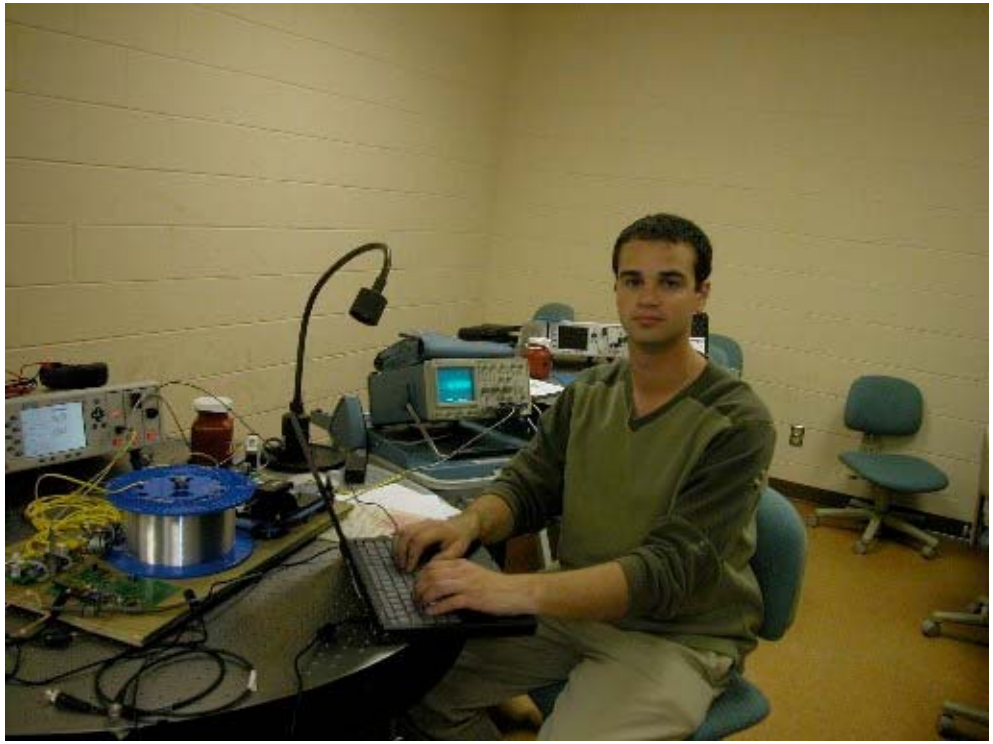


CO_2 Laser

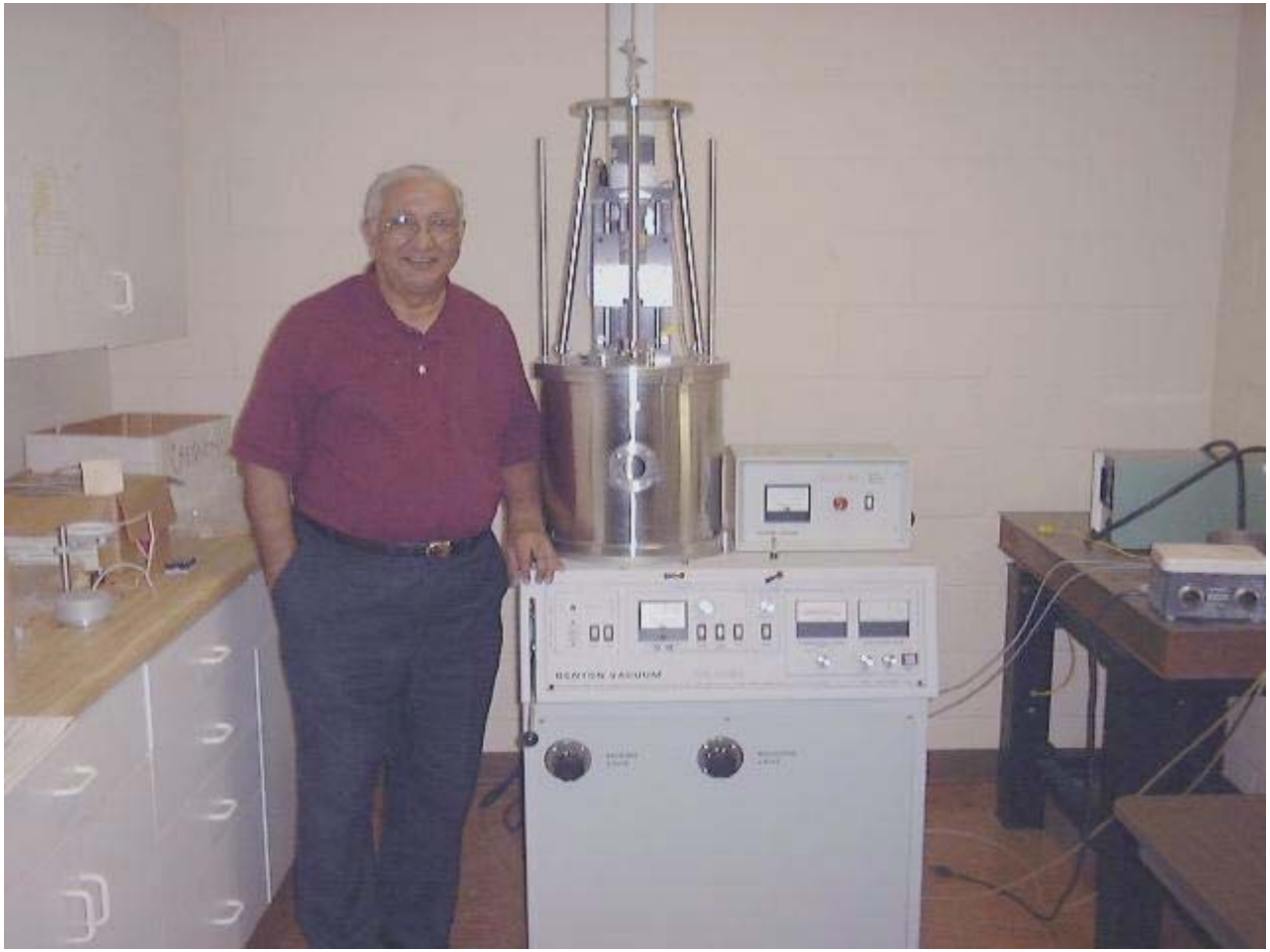
Interferometer for Cleaving Fibers

Nd:YAG laser

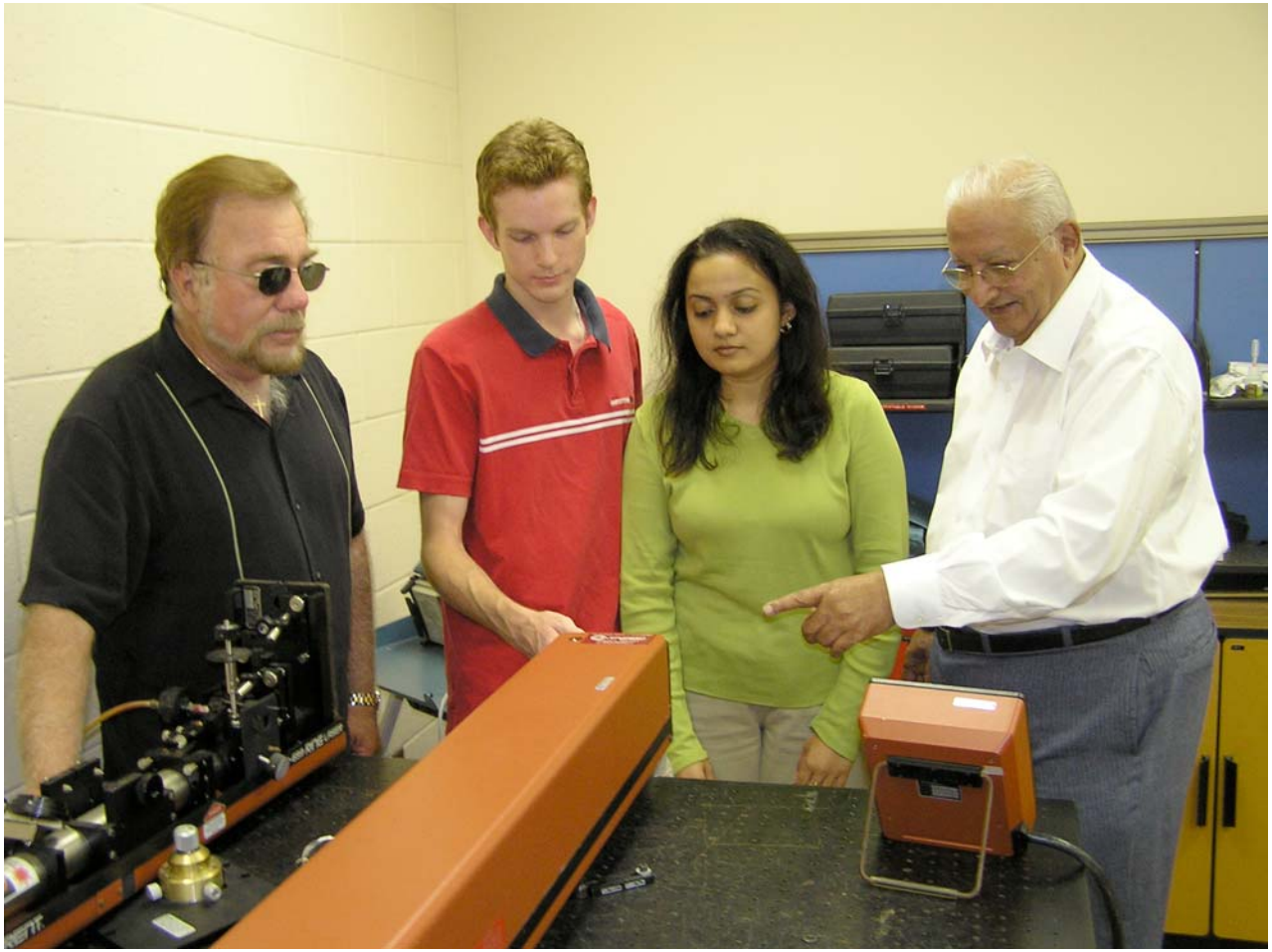
Fiber Optics Laboratory



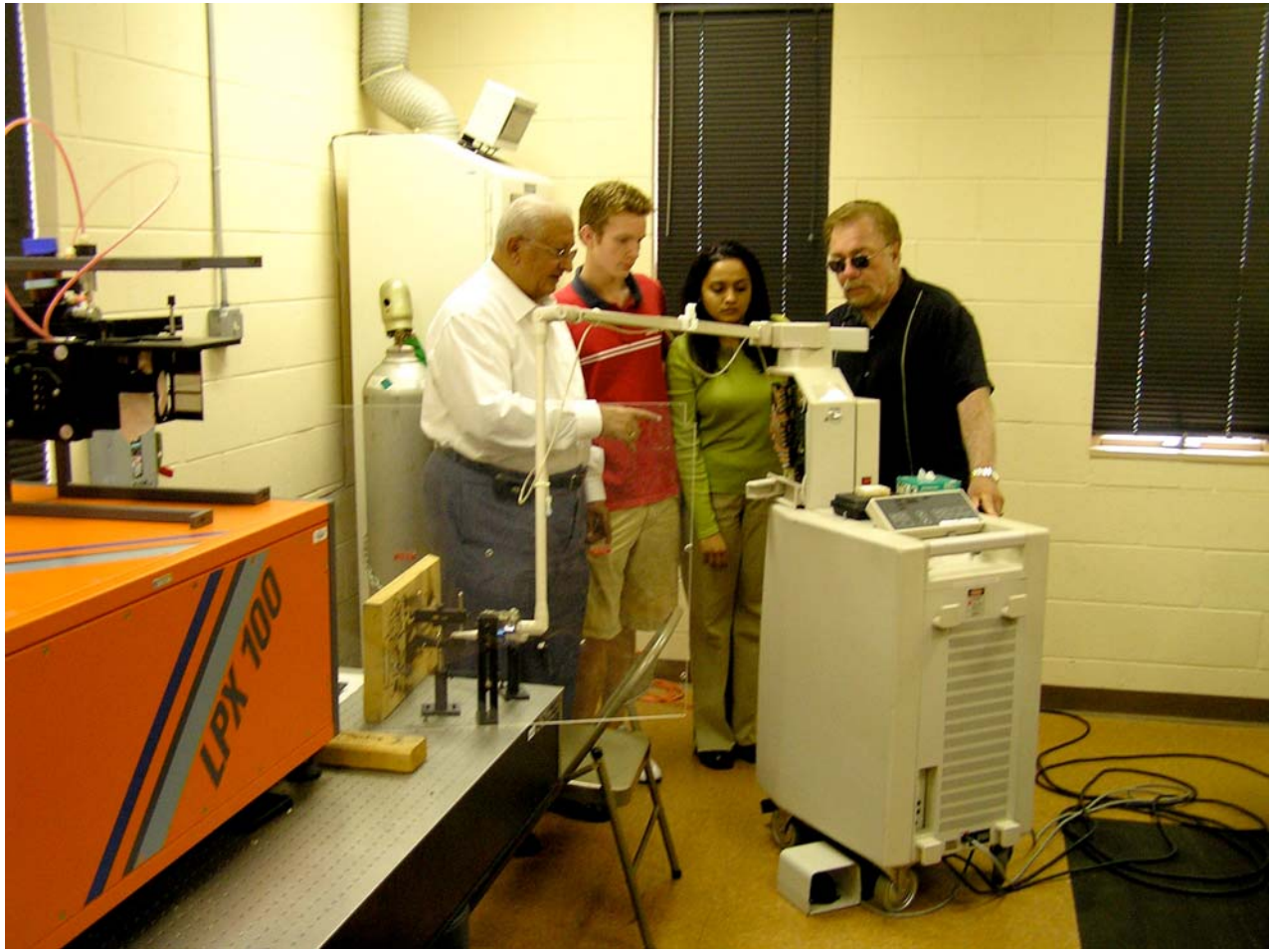
Vacuum Deposition Machine



Ion Laser



CO_2 Laser



Photonics – Fiber Optics Technology Option
Course Descriptions

LFO-241 Introduction to Fiber Optics (3.00 cr.)

This course will discuss elements of fiber optics including: integrated optics, waveguide transmission, optical circuitry, and fiber optic components.

LFO-242 Advanced Fiber Optics (3.00 cr.)

This course will continue to develop concepts in Fiber Optics that are introduced in Introduction to Fiber Optics (LFO-241). However, much greater emphasis will be placed on splicing, coupling, optical systems, and optoelectronics.

Photonics – Fiber Optics Technology Option
Course Descriptions
(Continued)

LFO-243 Fiber Optic Communication & Installation (3.00 cr.)

This course will continue to develop concepts introduced in the course LFO-241 (Introduction to Fiber Optics). It is designed for the certificate in Fiber Optics with great emphasis put on the tasks and functions needed to perform different fiber optic installations, connections, and testing and troubleshooting optical communication systems.

LFO-294 Fiber Optic Project (3.00 cr.)

This course is designed to introduce the student to creative fiber optic design by participation in small project groups. Each group will be assigned a fiber optic problem to solve by using innovative optical circuitry and possibly the construction of a working model.

Photonics - Laser/ Electro-Optics Technology Option
Course Descriptions

LFO-101 Intro to Photonics & Photonic Safety (4.00 cr.)

This course introduces the elements of a laser, operation of a helium-neon gas laser, laser physics, optical-cavities, properties of laser light, and a survey of laser systems. Safety procedures concerning lasers and related equipment are presented in this course.

LFO-201 Photonic Materials (3.00 cr.)

Photonic Materials is a course designed to provide the laser electrooptic technology and fiber-optic technology students an up-to-date knowledge of the laser peripheral materials. The material selection and characterization of different laser materials and peripheral materials, such as electro-optic, acousto-optic, and nonlinear materials will be included in the course. In the course the basis for material selection and suitability for laser application will be stressed. Laboratory experiments will supplement the basic non-mathematical theory. Practical applications will be stressed in this course.

Photonics - Laser/ Electro-Optics Technology Option
Course Descriptions
(Continued)

LFO-211 Photonic-Optic Principles & Components (4.00 cr.)
This course covers the fundamentals of geometric and physical optics, including Huygen's principle, wave motion, properties of waves, and optical instruments.

LFO-212 Pulsed & CW Lasers (3.00 cr.)
This course covers the laser power and energy measurements, characteristics of flashlamps, discharge circuits, and pulse forming networks for optically pumped solid lasers, CW arc lamps and power supplies for CW lasers, cooling systems for CW-pumped lasers, safe operation and measurements with argon, C02, ruby, Nd: YAG, dye and semiconductor lasers, study of laser Q-switching and modelocking using solid state laser systems.

Photonics - Laser/ Electro-Optics Technology Option
Course Descriptions
(Continued)

LFO-251 Laser Electronics (3.00 cr.)

The course introduces the student to the electronics of laser power supplies. Constructions of power supplies for electrically excited molecular and ion gas lasers, optically pumped CW and pulsed solid-state lasers, and semiconductor lasers are considered. The course also considers electrical safety procedures necessary during troubleshooting and repairing electrical components of lasers.

LFO-261 Laser Bio-Physics Technology for Allied Health (3.00 cr.)

This course will discuss elements of a laser, properties of light, survey of laser systems, safety procedures concerning lasers, and related equipment. This course will also concentrate on laser surgical techniques, both in the office and in a hospital setting.

Photonics - Laser/ Electro-Optics Technology Option
Course Descriptions
(Continued)

LFO-231 Photonics Measurements (3.00 cr.)

This course will discuss wave length, dispersion, and refractive index measurements with divided-circle prism/grating spectrometer, use of monochromators and spectrophotometers, use of scanning Fabry-Perot interferometer for observation of longitudinal modes in a laser output, use of fixed spacing Fabry-Perot etalon, Michelson interferometer, use of Twyman-Green interferometer in optical testing, use of Mach-Zehnder interferometer for measuring refractive index of gas, spatial resolution, concept of the modulation transfer function (MTF), and use of USAF 1951 resolution target to measure MTF of a lens.

LFO-292 Photonics Seminar (1.00 cr.)

Photonics seminar provides an opportunity for the photonic and fiber optic student to become familiar with the current job market, resume writing and interview techniques. Also, a discussion of current events in photonics technology will take place.

Photonics - Laser/ Electro-Optics Technology Option
Course Descriptions
(Continued)

LFO-221 Photonic & Electro-Optic Devices (3.00 cr.)
This course will discuss the photodetectors, calorimeters and laser power meters, holographic equipment and supplies, and techniques and setups for making holograms. It covers photographic instrumentation, including oscilloscope, SLR, streak cameras and special purpose imaging devices. Laser modulation and Q-switching devices, including electro-optic, rotating prism, acousto-optic and bleachable dye methods, use of laser collimators and autocollimators, spatial filters, beam expanders, and Faraday isolators, are also covered in this course.