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ABSTRACT

A project was conducted at the Community College of Luzerne County (Pennsylvania) to develop, in cooperation with area vocational-technical schools, the first year of a competency-based curriculum in laser/electro-optics technology. Existing programs were reviewed and private sector input was sought in developing the curriculum and identifying needed equipment and facilities. The curriculum developed by the task force is included in this document, presented in three sections. The first section covers general business/industry trends; the laser technician; the laser/electro-optics technology program; program competencies; course competencies; special laboratory equipment; articulation; and a proposed second-year course listing. The second section lists the educational specifications for laser/electro-optics technology, and the final section specifies equipment needed for the program. Appendixes to the report list the task force members, describe the literature search, and provide a task listing with manufacturers' ratings of their relative importance. Sample task force letters complete the report. (KC)

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# FINAL REPORT

## DEVELOPMENT OF ARTICULATED COMPETENCY-BASED CURRICULUM IN LASER/ELECTRO-OPTICS TECHNOLOGY
CONTRACT NUMBER 85-7010

Wesley E. Franklin, Project Director
Regina Antonini, Project Coordinator

Community College of Luzerne County
Nanticoke, Pennsylvania 18634

September 30, 1987

PENNSYLVANIA DEPARTMENT OF EDUCATION
BUREAU OF VOCATIONAL AND ADULT EDUCATION

## TABLE OF CONTENTS

### SECTION I

## SECTION VI -- ATTACHMENTS



## SECTION VII -- SAMPLE TASK FORCE LETTERS

SECTION I

ACKNOWLEDGEMENTS AND ABSTRACT

Business-
Industry-Education
PARTNERSHIP

# ACKNOWLEDGEMENTS

For most of us at the Community College of Luzerne County, this project involved the "breaking of new ground." We have all been involved, more or less, in various phases of curriculum development for several years. However, doing competency-based curriculum development, and doing it in areas that include most of the advanced technologies now being developed, was a difficult and time-consuming task. To be able to do what was done with curriculum development, while at the same time complete the planning for a new advanced technology center (82,000 square feet, $8 million) was an accomplishment that should be recognized. Listed below in alphabetical order are the names of those individuals involved; they are listed with the hope that the work they did will receive more substantial recognition when time and resources permit:

| | |
|---|---|
| Regina Antonini | Director, Institutional-Based and Community-Based Special Programs and Task Force Coordinator |
| Elaine Brown | Assistant to the Project Director |
| Patrick J. Santacroce | Executive Director, Institute for Developmental Educational Activities |
| Elizabeth Yeager | Research Specialist and Task Force Coordinator |
| Stephen Yokimishyn | Coordinator, Customized Job Training Programs |

A note of thanks also to the consultants Paul L. McQuay and Associates, and Alger, Dowling, and Paullin, and to members of the task force for their effective involvement and contributions.

A special note of thanks to Mr. Thomas J. Moran, President of the Community College of Luzerne County, for his patience, understanding, and flexibility. There were many times when other projects had to be deferred so work on this project could be completed.

Wesley E. Franklin
Project Director and
Director, BIE Partnership, IDEA
September 30, 1987

Institute for Developmental Educational Activities
Luzerne County Community College
Nanticoke, Pennsylvania 18634 717-829-7380

# A B S T R A C T

85-7010: Development of Articulated Competency-Based Curriculum in Laser/Electro-Optics Technology

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$37,627 Federal
7/1/86 to 6/30/87

The purpose of this project was to develop, in cooperation with area vocational-technical schools, the first year of a competency-based curriculum in laser/electro-optics technology.

OBJECTIVES

1. Establish a "laser/electro-optics" task force comprised of representatives from the community college, participating area vocational-technical schools, and the private sector.

2. Review materials on existing competency-based laser/electro-optics programs (provided by PDE Resource Center) and identify secondary, post-secondary, and overlapping levels of instruction.

3. Inventory and list existing equipment, facilities, and courses available from all participating institutions related to proposed program.

4. Obtain private sector input on competencies needed by entry-level laser technicians, and integrate into curriculum materials development activity.

5. Develop rationale/procedures for program articulation between each AVTS and the community college.

6. Develop competency based curriculum materials and review with PDE representatives.

7. Identify equipment and facilities needed to offer articulated programs at AVTS's and community college, with emphasis on non-duplication of high-cost items.

8. Prepare final draft of CBCM and review with deans and directors from each institution.

OUTCOMES

1. Task force was formed, met regularly throughout the year, and provided significant input into curriculum development/articulation process.

2. Curriculum materials and equipment information from other schools was obtained and reviewed; visits were made to two AVTS's and one community college offering similar programs(electronics).

3. Sample competency lists were developed and mailed to private sector for validation.

4. Consultants were used to develop first-year curriculum and facilities/ equipment specifications.

5. Proposed curriculum and articulation process was reviewed and approved by AVTS directors and community college deans.

AUDIENCE

The resulting report and curriculum materials will be distributed to participating AVTS's, PDE, task force, community college, and private sector.

PUBLISHED MATERIALS--Final Report

## SECTION II

## NARRATIVE

# METHODOLOGY

This curriculum materials development project began with the formation of a task force whose membership included representatives from the three area vocational-technical schools: Lackawanna, West Side and Wilkes-Barre (see ATTACHMENT #1). In the initial grant proposal, the stated plan was to use vo-tech faculty (task force) to assist in curriculum development and in identification of equipment and facilities needed for the program. After several meetings with the task force during the fall semester, this approach did not appear to be feasible because of time and expertise limitations -- most of the members of the task force taught evening courses as well as teaching full-time during the day. Also, because the proposed program is a new technology, there was a significant amount of research that had to be done, both for the college and the task force.

For these reasons, it was decided to use expertise already available, namely consultants, and have the task force function in a review/reaction mode once there were materials/reports from the consultant to consider. This way, the task force's knowledge of the local educational and industrial training requirements could be used to make appropriate changes in the consultant's reports and recommendations so the proposed program would be in line with the needs of the college's service area. Also, representatives of the college's engineering and science departments, administration, and from the private sector were able to participate in the process and provided valuable input throughout.

ATTACHMENT #2 lists the various programs and publications that were reviewed as part of the project's data search. Upon completion of this review, a list of sample competencies was developed and sent to area manufacturers. A copy of the list, showing the summarized competency rankings, is included as ATTACHMENT #3. As part of this process, the project coordinator, task force coordinator, and department director met with a representative from the Pennsylvania Department of Education who reviewed the requirements of the Bureau of Vocational Education for competency-based programs/courses.

Those materials found to be most pertinent, along with the results of the private sector reviews of the sample competencies, were then sent to the consultant as background for the proposed first-year curriculum. Also, one of the results of the task force's review process was the recommendation that the best articulation procedure would be one which provided advanced placement for competencies and/or knowledge rather than attempt to integrate a secondary with a post-secondary curriculum, trying to fit the student in wherever he or she happened to be on the competency continuum. The consultant agreed with this recommendation and included a separate section on articulation in his report. This report is included, in its entirety, under SECTION III.

## ANALYSIS/EVALUATION

The proposed first-year program, along with the proposed equipment and facilities plan, were first evaluated by the task force. The task force made several recommendations to the consultants, which were incorporated into the final documents. These documents were then reviewed and approved by the appropriate community college administrators and the directors of the participating AVTS's.

## DISSEMINATION

Copies of the final report will be distributed to the following:

Bureau of Vocational and Adult Education, PDE

Area Vocational-Technical Schools

Private Sector participants

Members of Task Force

Consultants

Ben Franklin Partnership

Pennsylvania Economic Development Partnership

Economic Development Council of Northeastern Pennsylvania

Because this is the first year of a two-year project, the final report for the second year will include the complete curricular program, including the associate degree and the certificate of specialization. Upon completion, approximately one year from now, that report will receive more widespread distribution. A listing of courses for the second year is included at the end of the consultant's report for this year.

# SECTION III

# CONCLUSIONS AND RECOMMENDATIONS

# LASER/ELECTRO-OPTICS TECHNOLOGY

# CURRICULUM

(One Year Program of Study)

LUZERNE COUNTY COMMUNITY COLLEGE

Nanticoke, Pennsylvania 18634

June, 1987

LASER/ELECTRO-OPTICS TECHNOLOGY
CURRICULUM

General Business/Industry Trends

The use of Electro-Optics Laser Technology, both in industry and in research has shown dramatic growth in the past 10 years. Some studies have indicated the need for 360,000 laser technicians nationally by 1990. High technology industries tend to congregate in certain geographical areas. A recent report indicated that 83% of high technology manufacturing employment is located in only 24 states.[1] Because the laser industry is developing most rapidly in the heavily populated areas of the East Coast and West Coast, these sections of the country appear to have the greatest employment opportunities in the near future. However, excellent employment opportunities are now becoming evident in midwestern areas such as Chicago, Minneapolis, Milwaukee and Detroit.

The starting salary for electro/optic-laser technicians range from $15,600 to $18,200 per year in the metropolitan Philadelphia area. Salaries for experienced technicians average approximately $26,000 per year depending upon background and experience.

Since Luzerne County Community College has an Electrical-Electronics Technology program, the development of a laser program becomes a natural progression in curriculum development.

[1] The State Role in Implementing a High Technology Program. National Workshop on High Technology Careers. John H. Lloyd, St. Louis, Missouri, December 2, 1982.

A laser technology program introduces an educational program that surpasses the traditional offering. This new program will be a service to that portion of the population that currently is not being served; i.e., electronics technicians, junior engineers, and other working professions. A more in-depth analysis of this technology is presented below. The following materials discuss educational requirements, employment outlook, Philadelphia area employment (because it was readily available and represented the largest employment area in Pennsylvania), national salaries, benefits and working conditions, and advancement opportunities.

LASER TECHNICIAN
D.O.T. #: 019,181-101

Educational Requirements:

The skills of high technology are acquired by developing an understanding of the physical sciences and how they are applied. A total "systems" approach is emphasized including knowledge of applied physics. Students interested in high tech careers should study core courses in high school and then complete their education at a community college or technical school. This allows students to move from high school to post-secondary school without duplicating courses.

Employment Outlook:

Laser technology is a "high tech" field with a very good employment outlook. Studies indicate that 360,000 industrial laser process technicians will be needed in the United States by 1990.

Philadelphia Area Employment:

Current applications of laser technology are relatively new. Users of lasers can be found in the following industries: construction and excavation; machining and materials working; communications; surveying; testing and measurement; data processing; photo optics; medicine and surgery; military; clothing manufacturing; and research and development.

The potential uses for laser technology are considerable. They are already being used in supermarket checkout counters, gyroscopes to aid navigation, film animation, information transmission, printing, and other areas. Show business uses lasers to entertain audiences by creating color, patterns, and movement to accompany music.

Refer to your local "Yellow Pages" under "Lasers" for listings of possible employers in your area.

Most laser manufacturing firms are located in California -- in the famous "Silicon Valley" area and in southern California. Others are located in metropolitan Boston (Massachusetts).

<u>Salaries/Wages - 1987</u>:

| | |
|---|---|
| Phila. Area Ave. Starting Salary: | $15,600 to $18,200/yr. |
| Phila. Area Average Salary: | $23,400 to $28,400/yr. |
| Maximum Salary: | $33,800/yr. |

## ALL ENGINEERING TECHNICIANS

<u>National Average Annual Salaries - 1986</u>:

| | | |
|---|---|---|
| Engineering Technicians | 1 | $16,881/yr. |
| Engineering Technicians | 2-3 | $20,312-$23,896/yr. |
| Engineering Technicians | 4-5 | $28,412-$32,718/yr. |

<u>Benefits, Working Conditions, Advantages & Disadvantages</u>:

1. Some laser technicians work in laboratory-like conditions. Others are employed at construction sites, manufacturing plants, hospital operating rooms, and others.
2. Working conditions are good.
3. Most work a five day, 40 hour week.
4. The usual benefits are available: health and life insurance, paid holidays and vacations, sick leave, etc. Some employers provide their employees with paid prescription, optical and dental plans.
5. Laser technicians often work as part of a team, sometimes with scientists and engineers.

Disadvantages:

1. The training program for laser technicians is difficult.
2. The work can be dangerous if safety procedures are not followed. Power supplies for many lasers involve high voltages, and direct exposure to a laser beam is a possible source of danger.
3. Special eye protection is worn when working around lasers.

Advancement Opportunities:

Laser technicians*, with experience and ability, can advance to laser technologists**. Some become field laser technicians, working outside of the laboratory in business settings, hospitals and other sites where lasers are used.

*Generally requires a two-year college degree or equivalent.
**Generally requires a four-year college degree or equivalent.

## LASER/ELECTRO-OPTICS TECHNOLOGY

### Recommended Program of Studies
### Leading to the A.A.S. Degree

The theory and applications of Laser/Electro-Optical technology are emphasized in this program. A broad-based knowledge of electronics, optics, and lasers is required for competency in this emerging technology. The purpose of the program is to prepare graduates for entry-level positions in industry, business, and government, for assignments such as laser operator, laser technician, and electro-optical sales.

The program is sufficiently comprehensive to also allow graduates the opportunity to transfer to other institutions to pursue advanced studies.

**First Semester**

| | Credits |
|---|---|
| Introduction to Lasers | 4 |
| Technical Mathematics I<br>MAT 111 | 5 |
| D.C. Electricity<br>IEL 131 | 4 |
| English Composition I<br>ENG 101 | 3 |
| | 16 |

**Second Semester**

| | Credits |
|---|---|
| Laser Optics | 4 |
| Technical Mathematics II<br>MAT 112 | 5 |
| A.C. Electricity<br>IEL 132 | 3 |
| Technical Physics I<br>PHY 123 | 4 |
| Electronic Devices<br>IEL 135 | 3 |
| | 19 |

## LASER/ELECTRO-OPTICS TECHNOLOGY PROGRAM COMPETENCIES

This program is designed to meet the needs in the areas of Medicine and Surgery, Specialized Materials, Medical Devices and Scientific Instrumentation, Communications Services and Equipment, Construction, and Manufacturing.

Electro/Optical Laser technicians are trained in electricity, electronics, mechanical, optical, fluid, thermal, and optical hardware. Laser technicians must understand the properties and principles of lasers, mirrors, light sources, and power supplies.

Upon successful completion of this program the technician must be able to:

*** operate laser systems.

*** troubleshoot and repair lasers.

*** operate interferometers, spectrometers, monochromators, and spectrophotometers.

*** operate and calibrate photodetectors, photomultipliers, optical power meters, and calorimeters.

*** fabricate and assemble components for laser/electro-optic devices.

*** troubleshoot and repair electro-optic devices.

*** produce and reconstruct holograms.

*** perform optical inspections and cleaning of optical components.

*** maintain a laboratory notebook, perform data reduction, and prepare reports.

*** prepare and read shop drawings and schematics.

*** perform tests and measurements using electronic devices.

Laser technicians can be found in many industries. In hospitals, they maintain and adjust the intensity and depth of the laser beam penetration for surgical procedures. The technician couples the laser to a robot in automated manufacturing for welding, drilling and cutting metal. The lasers in supermarkets and libraries are serviced by laser technicians.

Technicians may be involved in laser assembly and production; maintenance and operation; troubleshooting and repair; research and development; or sales and service in a number of areas.

Course Competencies For:

1. Introduction to Lasers 4 credits

2. Course Description: This course presents an overall view of laser properties, principles of operation and safety. The theory of light and laser operation concludes with an in-depth study of the Helium-Neon low power gas laser.

Suggested Audience: Laser/Electro-Optical Technical Students.

Co-requisites: Math 111, IEL 131

3. Course Competencies/Behavioral Objectives

Competency 1: Elements and Operation of a Laser. In order to attain this competency, the student should be able to:

1.1 Define the properties of laser light.

1.2 Describe the process of stimulated emission.

1.3 Draw the basic elements of several types of lasers.

1.4 List the safety precautions for operating low powered lasers.

1.5 Operate a helium-neon laser safely.

1.6 List safety precautions applicable to all types of lasers.

1.7 Determine the power of a laser beam.

1.8 Understand the use of a photoelectric power meter.

1.9 Indicate how the eye can be damaged by laser emissions.

1.10 Describe the types of reflection and determine the eye hazards involved.

Competency 2: Properties of Light-Emission and Absorption of Light. In order to attain this competency, the student should be able to:

2.1 Define frequency, wave length, period, phase, and polarization.

2.2 Sketch and label a plane-polarized electromagnetic wave.

2.3 Explain the significance of Brewster's angle.

2.4 Calculate and measure Brewster's angle given the index of refraction.

2.5 Sketch plane and spatial wave fronts.

2.6 Understand temporal and spatial coherence.

2.7 Measure wavelengths using a grating spectroscope.

2.8 Determine the wavelength, frequency, and energy of a photon.

2.9 Describe the stimulated emission of a photon by an atom.

2.10 Explain Doppler broadening of a spectral line.

2.11 Observe and compare the absorption spectra of Nd:YAG and Nd:glass.

Competency 3: Lasing Action - Optical Cavities and Modes of Operation. In order to attain this competency, the student should be able to:

3.1 Explain absorption coefficient.

3.2 Understand the exponential law of absorption.

3.3 Given the optical density of a filter, calculate its transmission.

3.4 Explain normal population distribution and inversion.

3.5 Sketch gain vs. wavelength for a typical laser emission line.

3.6 Draw the energy-level diagram of a laser.

3.7 Measure the transmission of colored filters at the HeNe laser wavelength.

3.8 Draw a diagram of an optical cavity.

3.9 Explain the loss in an optical cavity.

3.10 Determine the gain and output power as a function of time for CW and pulsed lasers.

3.11 Discuss the advantages and disadvantages of different laser cavities.

3.12 Illustrate the longitudinal modes in a typical laser system.

3.13 Clean and align an open cavity HeNe laser.

Competency 4: Temporal and Spatial Characteristics. In order to attain this competency, the student should be able to:

4.1 Define pulse duration, repetition rate, and peak power.

4.2 Define normal, Q-switched, and mode locked laser pulses.

4.3 Graph amplifier gain, loop gain, and power vs. time in a Q-switched laser.

4.4 Explain mode-locking.

4.5 Determine frequency bandwidth of laser output.

4.6 Determine longitudinal coherence length.

4.7 Measure the temporal output characteristics of a repetitively pulsed laser.

4.8 Sketch some transverse electromagnetic modes of a laser.

4.9 Draw and label the irradiance of the TEMoo mode as a function of beam width.

4.10 Explain the significance of the TEMoo mode in lasers.

4.11 Calculate diffraction-limited beam divergence.

4.12 Determine beam divergence angle.

4.13 Explain the near field and the far field of a laser.

4.14 Measure transmission through a calibrated aperture.

Competency 5: The Helium-Neon Lasers and Others. In order to attain this competency, the student should be able to:

5.1 Explain the energy transfer process.

5.2 Describe superradiant lasing.

5.3 Calculate the helium and neon gas pressures for maximum power output.

5.4 Draw a voltage versus current curve for a HeNe laser.

5.5 Explain the failure mechanisms of HeNe lasers.

5.6 Understand the operation of various lasers including HeNe, Argon, $CO_2$, Ruby, Nd:YAG, etc.

5.7 Discuss operating efficiency of several lasers.

5.8 List the types of gases used as the active media of lasers.

5.9 Discuss applications of semiconductor lasers.

Required Course Textbooks:

Introduction to Lasers

Laser/Electro-Optical Technology Servies Vol.1

Center for Occupational Research & Development

Methods of Evaluation:

How will the grade for the course be computed:

| | |
|---|---|
| Tests | 60% |
| Laboratory | 20% |
| Homework/Final | 20% |

Attendance Requirements:

Students are expected to adhere to the attendance requirements that are delineated in the college catalog.

Safety Considerations:

Students are urged to dress appropriately, exercise caution in the laboratory, and wear eye protection when recommended.

Summary of Topics/Course Outline:

| | Chapter | Weeks |
|---|---|---|
| Elements and Operation of a Laser | 1 | 1 |
| Elements and Operation of an Optical Power Meter | 2 | 1 |
| Introduction to Laser Safety | 3 | 1 |
| Properties of Light | 4 | 2 |
| Emission and Absorption of Light | 5 | 1 |
| Lasing Action | 6 | 1.5 |
| Optical Cavities and Modes of Operation | 7 | 1.5 |
| Temporal Characteristics of Lasers | 8 | 1 |
| Spatial Characteristics of Lasers | 9 | 1 |
| Helium-Neon Gas Laser - A Case Study | 10 | 1 |
| Laser Classifications and Characteristics | 11 | 2 |
| Review | | 1 |

Course Competencies For:

1. Laser Optics 4 Credits

2. Course Description: The geometrical ray nature of light through mathematical and graphical methods forms the first half of this course. Reflection, refraction, and propagation of light from the viewpoint of wave optics is studied in the second half of this course. Holography is the final topic.

Suggested Audience: Laser/Electro-Optical Technology Students

Pre-requisites: Introduction to Lasers

3. Course Competencies/Behavioral Objectives

Competency 1: Geometrical Optics. In order to attain this competency, the student should be able to:

1.1 Define the properties of light rays.

1.2 Trace the path of light rays at plane and spherical surfaces.

1.3 Predict the direction of reflection of light rays on plane and spherical surfaces.

1.4 Experimentally verify the law of reflection.

1.5 Understand the principles of refraction.

1.6 Define the relative and absolute index of refraction.

1.7 Understand color dispersion.

1.8 Using the graphical ray tracing technique, determine the refraction angle at plane and spherical surfaces.

Competency 2: Optical Systems and Components. In order to attain this competency, the student should be able to:

2.1 Define a thin lens, converging lens and diverging lens through a series of sketches.

2.2 Identify the following lens: equi and plano convex, positive and negative meniscus, equi and plano concave.

2.3 Determine analytically, graphically, and experimentally the primary and secondary focal points of various lenses.

2.4 Diagram and define field stop and aperture stop.

2.5 Identify the exit pupil, the entrance pupil, and aperture stop for two lenses analytically and graphically.

2.6 Illustrate the principle of a simple magnifier.

2.7 Calculate lateral and angular magnification.

2.8 Understand the working principle of a compound microscope.

2.9 Draw two different types of laser beam expanding collimators.

2.10 Outline a ray tracing procedure for an optical system.

Competency 3: Fundamentals of Light. In order to attain this competency, the student should be able to:

3.1 Describe a point source of light.

3.2 Measure the irradiance of a point source of light.

3.3 Identify different types of spectra.

3.4 Using a spectral source, produce line, band, and continuum spectra.

3.5 Differentiate between radiometry and photometry.

3.6 Plot the standard luminosity curve and explain.

3.7 Convert between spectral photometric and spectral radiometric quantities.

3.8 Measure irradiance and illuminance for a HeNe laser.

Competency 4: Wave Nature of Light - Reflection and Refraction. In order to attain this competency, the student should be able to:

4.1 Distinguish between geometrical and wave optics.

4.2 Explain wave parameters including wavelength, frequency, wave number, and wave speed.

4.3 Understand and explain Huygen's principle.

4.4 Apply Huygen's principle to develop by construction both reflected and refracted plane waves.

4.5 State the laws of reflection and refraction.

4.6 Discuss Fresnel's equation for the percentage of light reflected from a di-electric surface.

4.7 Test the law of reflection and refraction at a di-electric interface.

Competency 5: Attenuation of Light. In order to attain this competency, the student should be able to:

5.1 Discuss laser propagation through the atmosphere.

5.2 Define beam irradiance, absorption coefficient, transmittance, and optical density.

5.3 Measure the transmittance of a laser beam through a material and determine absorption coefficient.

5.4 Define scattering mechanisms; in particular Raleigh, Mie, and diffraction scattering.

5.5 Demonstrate an understanding of interference.

5.6 Explain the importance of coherence in the interference process.

5.7 Understand the meaning of diffraction.

5.8 Distinguish between Fraunhofer and Fresnel diffraction.

5.9 Sketch several Fraunhofer diffraction patterns.

5.10 Explain the meaning of Raleigh's criterion for determining the limit of resolution.

5.11 Define diffraction-limited optics.

5.12 Produce the far field diffraction pattern of a laser beam due to several different openings.

Competency 6: Polarization and Holography. In order to attain this competency, the student should be able to:

6.1 Understand the difference between natural and polarized light.

6.2 Define linear, circular, and elliptical polarization of light.

6.3 Discuss methods for producing polarized light.

6.4 State the law of Malus.

6.5 Describe the effect of wave retarders or wave converters on polarized light.

6.6 Determine the state of polarization of light of unknown polarization.

6.7 Draw an experimental arrangement that can be used to produce a transmission hologram of a three-dimensional object.

6.8 Make a hologram of a three-dimensional object, develop the film, and reconstruct the virtual image.

Required Course Textbooks:

<u>Geometrical Optics</u>

<u>Laser/Electro-Optical Technology Series Vol. 2</u>

<u>Center for Occupational Research & Development</u>

<u>Light Sources and Wave Optics</u>

<u>Laser/Electro-Optical Technology Series Vol. 5</u>

<u>Center for Occupational Research & Development</u>

Methods of Evaluation:

Tests
Laboratory
Homework/Final

Attendance Requirements:

Students are expected to adhere to the attendance requirements that are delineated in the college catalog.

Safety Considerations:

Students are urged to dress appropriately, exercise caution in the laboratory, and wear eye protection when recommended.

Summary of Topics/Course Outline:

| | Chapter | Weeks |
|---|---|---|
| Reflection and Ray Tracing | 2-1 | 1 |
| Principles of Refraction | 2-2 | 1 |
| Refraction and Ray Tracing | 2-3 | 0.5 |
| Imaging With a Single Lens | 2-4 | 1 |
| Imaging With a Multiple Lens | 2-5 | 0.5 |
| F-Stops and Apertures | 2-6 | 0.5 |
| Optical Systems | 2-7 | 1 |
| Matrix Optics | 2-8 | 1 |
| Light Sources and Their Characteristics | 5-1 | 1 |
| Radiometry and Photometry | 5-2 | 1 |
| Wave Nature of Light | 5-3 | 1 |
| Reflection and Refraction | 5-4 | 1 |
| Propagation | 5-5 | 1 |
| Interference | 5-6 | 1 |
| Diffraction | 5-7 | 1 |
| Polarization | 5-8 | 1 |
| Holography | 5-9 | 0.5 |

Special Lab Equipment List:

1. Helium-neon Laser unpolarized - either:
   Metrologic #ML869 (1.5 mw) $459
   Metrologic #ML855 (5.0 mw) $695

2. Photoelectric power meter with ambient light shade $135

3. Laser power meter $350

4. Grating spectroscope $250

5. Optical Bench system consisting of: (Metrologic $400)
   One meter bench
   Leveling base
   Pin carriers
   Mounting pins
   Laser holder
   Mirror holder
   Ring mount

6. Lenses (various combinations)
   Diverging
   Converging (5cm focal length)
   Thin lens positive
   Thin lens negative

7. Mirrors including:
   High reflectance (99% reflective @ 632.8 nm)
   Output mirror (1-2% transmissivity @ 632.8 nm)
   Plane
   Concave
   Convex

8. Prisms $60^{\circ}$, $45^{\circ} - 45^{\circ} - 90^{\circ}$

9. Filters
   632.8 nm
   neutral density (1% transmission)
   Set of 7 broadband interference filters
   Optical Industries #03F1B015

10. Set of precision apertures on 35 mm glass slides
    Single, double, and multiple slits
    Circular apertures
    Square aperture
    Grating (Pasco Scientific)

11. Collimator  Tropel #280
12. Polarizer  Coherent #32
13. Beam splitter  Oriel #261  $50
14. Beam expander (10X)  $190
15. Micrometer
16. Meter stick

# ARTICULATION

## (Secondary and Post-Secondary Education)

Vocational/occupational education supports the needs of local business and industry and prepares workers with entry-level skills. The need for articulation of programs is becoming more apparent due to growing local and national concerns for efficiency in education, rising costs of education, elimination of duplication of effort, and demands from the public for accountability.

Coordination of secondary and post-secondary programs was a major theme of the 1976 Federal educational legislation. The 1983 efforts of the Pennsylvania Advisory Council on Vocational Education fostered, among other things, stronger business and industry linkages with vocational programs and articulation efforts between secondary and post-secondary and adult vocational education programs.

In 1983, the Pennsylvania Advisory Council on Vocational Education made a recommendation on articulation agreements. The recommendation, as it addressed articulation, stated:

> 4. Articulation agreements between comprehensive schools, community colleges, colleges, universities and AVTS should be established. These agreements should stimulate joint efforts in facilities' utilization, curriculum planning, providing customized job training, utilizing business/industry contracts, etc. These agreements would be considered in the approval process for receiving state and federal vocational education funds.

Further, articulating programs between secondary area vocational-technical schools and the local community college would maximize the efforts and efficiency of our state educational system. This integration would be efficient and economical in terms of better use of facilities, staff and equipment, reduced length of study time, and the ability to address employer needs in a systematic plan.

In the development of this curriculum, the Laser/Electro-Optics Technology Program, it was intended to build upon maximum integration of at least two major state education delivery systems, the community college and the secondary vocational-technical system. With this articulation plan and cooperation in mind, a decision must be made as to which students could profit the <u>most</u> from this learning experience.

Generally speaking, secondary students with a mathematics, physics and/or electronics background seemed to have many of the basic skills necessary for a smooth articulation. These general categories suggest students from course selections such as:

* Electronics
* Electrical
* Electromechanical
* Mathematics, Science, Physics

* and other courses as deemed appropriate by a joint committee of the community college and the area vocational-technical school.

Specific courses which seem to be appropriate or reasonable starting points of exploration of articulation include:

* D.C. Electricity,
* Technical Mathematics,
* Technical Physics,
* A.C. Electricity, and
* Electronic Devices

While no one student would be expected to possess the background and/or competencies in all of the above courses, different students from various courses (programs) would have completed parts of or complete courses. Again, the determination of breadth, depth and evaluation of the articulation process should be determined by the joint committee.

Other courses not mentioned above should also be waived by students possessing competency in that area. Usually most institutions have an evaluation mechanism to assess that background.

**PROPOSED SECOND YEAR COURSE LISTING**

LUZERNE COUNTY COMMUNITY COLLEGE

LASER/ELECTRO-OPTICS TECHNOLOGY
Second Year

Third Semester

| Course | Credits |
|---|---|
| Laser Equipment and Measurements | 4 |
| GET _____ | |
| Electronic Amplifiers | 3 |
| Technical Physics II | 4 |
| Speech | 3 |
| Social Science Elective | 3 |
| | 17 |

Fourth Semester

| Course | Credits |
|---|---|
| Laser Applications and Projects | 4 |
| GET ____ | |
| Digital Circuits | 3 |
| Social Science Elective | 3 |
| Technical Report Writing | 3 |
| Health/Physical Education | 1 |
| | 14 |

SECTION IV

LASER/ELECTRO-OPTICS TECHNOLOGY

EDUCATIONAL SPECIFICATIONS

## LASER/ELECTRO-OPTICS TECHNOLOGY

### A. PROGRAM DESCRIPTION

Both an A.A.S. Degree program and a Certificate program are being developed for this technology. The laser/electro-optics program trains technicians to assist engineers in research, maintenance, troubleshooting, repair and testing of laser and electro-optics equipment. Laser/electro-optics technology is expanding tremendously. A few years ago the laser was merely a science-fiction device with great destructive power. Today, the laser is a beneficial tool serving medicine, industry, and entertainment.

### B. EDUCATIONAL OBJECTIVES

The major objective of this program is to prepare students as qualified laser/electro-optics technicians. Upon completion of the program students will be able to operate, maintain, troubleshoot, repair and test laser/electro-optics equipment.

### C. COURSE LISTING

Courses similar to the following are being developed for this new program at Luzerne County Community College:

- Laser Optics
- Laser Science
- Laser Measurements
- Optical-Production Technology
- Laser Devices
- Applied Holography
- Laser Projects

### D. MAJOR LEARNING ACTIVITIES

Students will be involved with conducting experiments and developing projects using laser/electro-optics equipment which will be located within several self-contained work areas within the laboratory. These laboratory activities will be carried out primarily with equipment mounted on self-leveling tables. Laboratory work will be supported with related classroom instruction.

### E. INSTRUCTIONAL SPACE REQUIREMENTS

| AREA | SQ. FT. |
|---|---|
| Laboratories (4 within 1) | 2,048 |

F. SUPPORT SPACE REQUIREMENTS

| AREA | SQ. FT. |
|---|---|
| Storage Room | 461 |
| Faculty Office (included with CIM) | |

G. LOCATION REQUIREMENTS

This laboratory should be located in close proximity to the electronics laboratories.

H. GENERAL DEVELOPMENT OF PHYSICAL PLANT

1. Climate Control

   a. A temperature of 65 degrees should be maintained during the winter months.
   b. All areas should be air conditioned.
   c. Each space should have a separate thermostat.

2. Acoustical Factors

   Each space should carry a STC rating of 37.

3. Illumination Factors

   a. General task lighting should be provided at 50 to 70 foot-candles (non-glare fixtures).
   b. Specific task lighting should be provided for extremely fine and detailed work.
   c. Each space should be controlled by a solid state rheostat.

4. Aesthetic Factors

   This area should be painted in light neutral tones.

5. Storage Facilities

   A separate storage room should be provided.

6. Vertical Instructional Surfaces

   a. Provide a 4' x 16' whiteboard.
   b. Provide a 4' x 4' tackboard at the primary entrance.
   c. Provide a wall mounted projection screen.

7. Utility Considerations

a. Electrical

1) Provide 110v. duplex outlets at 4'0" o.c. around perimeter of labs.
2) Provide 480v., 3 phase; 208v., 1 phase and 208v., 3 phase power distributed through bus duct or under floor duct the length of each lab.
3) Provide master shut-off with lock out in each lab.
4) Provide emergency shut-off switch, mushroom type, at 50'0" o.c. on perimeter walls of each lab or one per wall.
5) Provide wall mounted analog clock (electric) in lab.
6) Provide CCTV cabling and jack plate in lab.
7) Provide computer cabling in lab.

NOTE: 110v. power must be "clean".

b. Mechanical

1) Provide 100 psi compressed air at (4) wall mounted outlets in each lab.

8. Sanitation Requirements

Provide "in counter" sink.

9. Display Areas

No special requirements.

10. Provisions for Handicapped Students

General architectural provisions as required.

11. Special Entrances or Exits

No special requirements.

12. Special Built-in Equipment

See equipment lists.

13. Outside Lab Considerations

No special requirements.

14. Material Receiving and Shipping Requirements

No special requirements.

15. Type and Size of Outdoor Areas

No special requirements.

16. Surface Types

a. The floors in the laboratories should be carbon backed static proof carpet.
b. Masonry walls should be painted with oil base semi-gloss enamel.
c. Plaster and gypboard walls should be painted with semi-gloss enamel and have a 7'0" high epoxy wainscot.
d. The ceilings in all areas should be lay-in acoustical grid type ceilings.

17. Door Considerations

All man doors should be 40".

18. Ceiling Height

The minimum clear ceiling height is 9'0".

19. Window Considerations

No special requirements.

I. MAINTENANCE AND SAFETY FACTORS

1. Unusual Maintenance Problems

No special requirements.

2. Safety Factors

a. Provide emergency shut-off switches in each lab.

# SECTION V

## LASER/ELECTRO-OPTICS TECHNOLOGY

## EQUIPMENT SPECIFICATIONS

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology

DRAWING NO.:

ROOM NO.:

ORIGINATION DATE: 2-13-87

REVISIONS

4-17-87

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL H.P. | ELECTRICAL VOLTAGE | ELECTRICAL PHASE | ELECTRICAL AMPS | ELECTRICAL CONN. C/D | MECHANICAL AIR | MECHANICAL EXHAUST | MECHANICAL GAS | MECHANICAL WATER | MECHANICAL FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Projection Screen | $150.00 | F | | | | | | | | | | | | |
| | 5 | Air Outlets, wall mtd. | NA | F | | | | | | | | | | | | By Mech. Contractor |
| | 4LF | Tackboard | NA | F | | | | | | | | | | | | |
| | 1 | Wash-Up Area | NA | F | | | | | | | | | | H&C | | By Mech. Contractor |
| | 5 | Sink Counters | $14,000.00 | F | 8'x24"x36" | | | | | | | | | H&C | | |
| | 1 | Master Electrical Control | NA | F | | | | | | | | | | | | By Elec. Contractor |
| | 3 | Panic Electrical Control | NA | F | | | | | | | | | | | | By Elec. Contractor |
| | 1 | Access Door Safety Interlock System | NA | F | See Plan | | | | | | | | | | | By Elec. Contractor |
| | 2 | Laboratory Warning Lights | NA | F | See Plan | | | | | | | | | | | By Elec. Contractor |
| | 4 | Safety Curtains | NA | F | See Plan | | | | | | | | | | | By Architect |
| | AR | Safety Glass, high absorption type | NA | F | See Plan | | | | | | | | | | | By Architect |
| | 1 | Remote Laser Operation Control Panel | NA | F | See Plan | | | | | | | | | | | By Elec. Contractor |
| | 12 | Storage Cabinets | $3,000.00 | M | 36"x24"x84" | | | | | | | | | | | |
| | 15LF | Storage Shelving | $1,300.00 | M | See Plan | | | | | | | | | | | |
| | 6 | Carts, laboratory, portable | $900.00 | M | | | | | | | | | | | | |
| | 1 | Instructor's Demonstration Bench | $400.00 | M | | | 120 | 1 | 20 | D | | | | | | |

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.
DRAWING NO.:

ROOM NO.:
ORIGINATION DATE: 2-13-87

REVISIONS
4-17-87

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL: H.P. | VOLTAGE | PHASE | AMPS | CONN. C/D | MECHANICAL: AIR | EXHAUST | GAS | WATER | FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Stool/Chair, instructor's | $100.00 | M | | | | | | | | | | | | |
| | 20 | Stools/Chairs, student | $1,600.00 | M | | | | | | | | | | | | |
| | 5 | Student Optical Laboratory Equipment Sets, port., consisting of the following:<br><br>Optical Rail, 1 meter<br>Pin Carrier, 40mm<br>Pin Carrier, 90mm<br>Lens Holder, 50mm<br>Lens Holder, 100mm<br>X-Y Translator<br>Variable Iris<br>Aperture Wheel<br>Crosshair Accessory<br>Test Tube Holder<br>Power Supply, variable output<br>Detector, silicon<br>Multimeter, digital type<br>Lamp, incandescent<br>Laser, helium-neon type<br>Lens Assortment<br>Filter Assortment, color<br>Filter Assortment, line<br>Diffraction Grating<br>Slits, assorted | $6,000.00 | M | | | | | | | | | | | | |
| | 1 | Applied Physics Equipment Set, related, for 24 students | $7,500.00 | M | | | | | | | | | | | | |

49 50

ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.
DRAWING NO.:
ROOM NO.:
ORIGINATION DATE:
REVISIONS

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL H.P. | VOLTAGE | PHASE | AMPS | CONN. C/D | MECHANICAL AIR | EXHAUST | GAS | WATER | FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Microcomputer, with CRT, disk drive, monitor, printer and related software | $4,500.00 | M | | | 120 | 1 | 10 | C | | | | | | Data link to LAN |
| | 5 | Bench, vibration isolation type, Ealing #245472 | $25,000.00 | M | 4′ x 8′ | | | | | | | | | | | 1,500 lbs. |
| | 5 | Power Supply, laser type, port. #25-0894 | $4,000.00 | M | | | 120 | 1 | 5 | C | | | | | | |
| | 2 | Oscilloscope, dual trace, triggered sweep, port. | $3,000.00 | M | | | 120 | 1 | * | C | | | | | | *750 watts |
| | 8 | Multimeter, digital, laboratory quality, port. | $3,200.00 | M | | | 120 | 1 | * | C | | | | | | *250 watts |
| | 5 | Laser, helium, neon type, 2mW or 5mW power, with 0.63 or 0.81mm beam dia. and power supply, port. #25-0837 | $1,500.00 | M | | | 120 | 1 | * | C | | | | | | *50 VA |
| | 1 | Laser, argon type, with power supply, 10mW, port. | $1,800.00 | M | | | 120 | 1 | 20 | C | | | | | | High energy |
| | 1 | Laser, helium-cadium, 3mW, with power supply, port. | $1,350.00 | M | | | 120 | 1 | 20 | C | | | | | | High energy |
| | 24 | Laser Eyeshields, safety type | $480.00 | M | | | | | | | | | | | | |
| | 1 | Optics Demonstration Set, Frey #12175 | $600.00 | M | | | NA | | | | | | | | | |
| | 1 | Optical Disk, Hartl type, for demonstration of optics fundamentals with accessories SW-3675 | $425.00 | M | Portable | | 120 | 1 | * | C | | | | | | *100 watts |

51

52

ALGER, DOWLING, PAULLIN, INC.
P.O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.
DRAWING NO.:

ROOM NO.:
ORIGINATION DATE:

REVISIONS

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL: H.P. | VOLTAGE | PHASE | AMPS | CONN. C/D | MECHANICAL: AIR | EXHAUST | GAS | WATER | FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Ray Box, for project light demonstrations, w/accessories SW-3657 | $225.00 | M | Portable | | 120 | 1 | * | C | | | | | | *200 watts |
| | 1 | Refraction Demonstration Apparatus, counter mounted SW-3497 | $195.00 | M | Portable | | 120 | 1 | * | C | | | | | | *100 watts |
| | 1 | Ray Tracing Apparatus, counter mtd., with mirror and lens set for reflection and refraction experiments, Frey 13882 | $50.00 | M | Portable | | 120 | 1 | * | C | | | | | | *100 watts |
| | 5 | Optical Bench Set, lathe bed type, advanced, w/accessories Oriel | $50,000.00 | M | Portable | | NA | | | | | | | | | |
| | 2 | Laser Power Meter, portable, 0.003mW to 10mW range Oriel | $4,000.00 | M | Portable | | NA | | | | | | | | | |
| | 1 | Michelson Interferometer Demonstration Unit, for beam division experiments with Fabry-Perot and Twyman-Green conversion units SW-3559 | $200.00 | M | Portable | | NA | | | | | | | | | |
| | 1 | Holographic Non-Destructive Test System, with accessories and instruments | $879.00 | M | Portable | | NA | | | | | | | | | |
| | 1 | Telescope, 50mm beam expanding type, with spatial filter Oriel | $280.00 | M | Portable | | NA | | | | | | | | | |

53



54

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.

DRAWING NO.:

ROOM NO.:

ORIGINATION DATE:

REVISIONS

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL H.P. | VOLTAGE | PHASE | AMPS | CONN. C/D | MECHANICAL AIR | EXHAUST | GAS | WATER | FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | Physics Light/Optics Experiment Apparatus Set, consisting of the following: | | M | Portable | | NA | | | | | | | | | Provide 120v. convenience outlets |
| | | Universal Light Source, port., 50 watt lamp S44275-50 | $150.00 | M | | | | | | | | | | | | |
| | | Electromagnetic Radiation Chart, wall mtd. S18789-20 | $15.00 | M | | | | | | | | | | | | |
| | | Light Meter, precision type, port. S44361 | $175.00 | M | | | | | | | | | | | | |
| | | Total Reflection Apparatus, port. 3529 | $50.00 | M | | | | | | | | | | | | |
| | | Multiple Image Reflection Apparatus, port. 3526 | $51.00 | M | | | | | | | | | | | | |
| | | Mirror Set, with supports for reflection experiments 3510-3525 | $66.00 | M | | | | | | | | | | | | |
| | | Refraction Apparatus, precision type, port. 3497 | $200.00 | M | | | | | | | | | | | | |
| | | Refraction Tank, port. 3500 | $18.00 | M | | | | | | | | | | | | |
| | | Color Disks, motor driven, port., electric, stroboscope type 2470 | $130.00 | M | | | | | | | | | | | | |
| | | Optical Lens Assortment, for experiments | $200.00 | M | | | | | | | | | | | | |

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.

DRAWING NO.:

ROOM NO.:

ORIGINATION DATE:

REVISIONS

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL: H.P. | VOLTAGE | PHASE | AMPS | CONN. C/D | MECHANICAL: AIR | EXHAUST | GAS | WATER | FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Optical Plate Assortment, for experiments | $150.00 | M | | | | | | | | | | | | |
| | | Optical Prism Assortment, for experiments | $150.00 | M | | | | | | | | | | | | |
| | | Ray Box, for basic optics experiments, port., with accessories 3657 | $120.00 | M | | | | | | | | | | | | |
| | | Chalkboard Optics Demonstration Unit, with magnetic mounts with accessories 3666 | $550.00 | M | | | | | | | | | | | | |
| | | Optical Disk, multiple slit adjustment and accessories, port. 3675 | $250.00 | M | | | | | | | | | | | | |
| | | Light Source, sodium arc type, port., electric S705-70-05 | $400.00 | M | | | | | | | | | | | | |
| | | Light Source, mercury arc type, port., electric S705-80-10 | $375.00 | M | | | | | | | | | | | | |
| | | Light Source, ultraviolet type, port., electric | $425.00 | M | | | | | | | | | | | | |
| | | Telemicroscope, port., for image formation experiments with support bases | $120.00 | M | | | | | | | | | | | | |
| | | Function Generator, port., for sine/wave generation | $450.00 | M | | | | | | | | | | | | |
| | | Photometer, metro logic type, port. 3676P | $180.00 | M | | | | | | | | | | | | |

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.

DRAWING NO.:

ROOM NO.:

ORIGINATION DATE:

REVISIONS

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL: H.P. | ELECTRICAL: VOLTAGE | ELECTRICAL: PHASE | ELECTRICAL: AMPS | ELECTRICAL: CONN. C/D | MECHANICAL: AIR | MECHANICAL: EXHAUST | MECHANICAL: GAS | MECHANICAL: WATER | MECHANICAL: FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Laser Experiment Unit, laser optics type 3676K-40 | $180.00 | M | | | | | | | | | | | | |
| | | Holographic Experiment Unit, for use with laser 3804C | $160.00 | M | | | | | | | | | | | | |
| | | Microwave Optics Experiment Unit, for optics with transmitter, receiver and accessories 2643 | $700.00 | M | | | | | | | | | | | | |
| | | Microwave Diffraction Apparatus, Bragg type, for use with microwave transmitter and receiver, complete with crystals, goniometer and amplifier 2641 | $1,300.00 | M | | | | | | | | | | | | |
| | | Polariscope, vertical type, port., electric S70975 | $300.00 | M | | | | | | | | | | | | |
| | | Spectrometer, grating type, port. S75903-72 | $300.00 | M | | | | | | | | | | | | |
| | | Spectrometer, prism and grating type, port., with 60 degree prism, diffraction grating holders, crosshair illuminator S75903 | $100.00 | M | | | | | | | | | | | | |

59 60

ALGER, DOWLING, PAULLIN, INC.
P. O. BOX 2907
GRAND RAPIDS, MI 49501

PROGRAM: Laser Electro Optics Technology, cont.

DRAWING NO.:

ROOM NO.:

ORIGINATION DATE:

REVISIONS

| ITEM NO. | QTY. | DESCRIPTION | COST | M/F/E | SIZE L x W x H | ELECTRICAL H.P. | VOLTAGE | PHASE | AMPS | CONN. C/D | MECHANICAL AIR | EXHAUST | GAS | WATER | FL. DR. | COMMENTS: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Planck Constant Apparatus, quantum theory of light, port., electric, with accessories | $800.00 | M | | | | | | | | | | | | |
| | | FIXED TOTAL | $14,150.00 | | | | | | | | | | | | | |
| | | MOVABLE TOTAL | $130,549.00 | | | | | | | | | | | | | |
| | | GRAND TOTAL | $144,699.00 | | | | | | | | | | | | | |

61

62

SECTION VI

ATTACHMENTS

Citizens' Voice, Wilkes-Barre, Pa. Wednesday, September 17, 1986 — 42



# LCCC, area vo-techs plan technologies programs

## LCCC and vo-tech school representatives meet in joint session

Representatives from five area vocational-technical schools met recently with officials at Luzerne County Community College for the purpose of beginning the joint planning for development of curriculum materials for several new advanced technology programs.

Among the area vo-tech schools represented at the meeting, held at the school's Educational Conference Center, were Hazleton, Lackawanna, Susquehanna, West Side and Wilkes-Barre. The curricular programs involved in the project include Computer Integrated Manufacturing, Computer Repair Technology, Laser/Electro-Optics, Computer Assisted Design and Roboltics/Automated Systems.

The project between the community college and technical schools is designed to develop competency-based curricula which a student can begin at the secondary or vocational-technical school legel and continue at the post-secondary or college level without an interruption in studies.

Among those in attendance for the meeting, first row, from left, were: James Newell and Edward A. Shedlock, Wilkes-Barre AVTS; Gray Bossi; Henry Stachura and James Davis, Lackawanna County AVTS; Joseph Zmitrovich, Hazleton AVTS, and James Kane and David Lyons, West Side AVTS; second row: Wesley E. Franklin, [illegible]ctor of busines/industry/education partnership at [illegible]C; Ben Rondomanski, Lackawanna AVTS; James [illegible]gerty, Wilkes-Barre AVTS; Walter Rounds and Paul Liptay, Lackawanna AVTS; Linda M. Thomas, educational programmer at LCCC; Jo Anne Sabalske, video producer, LCCC, and Bill Karloltski, production engineer at LCCC; third row: Nathan Williams, Wilkes-Barre AVTS; Carol Adukaitis, Susquehanna AVTS; Dominic Pino, John Lenchak, Nicholas St. Maray, Hazleton AVTS; GFene Frick and Joseph Kasztejna, Lackawanna AVTSS; Ormond Lolng, Wilkes-Barre AVTS; Libby Yeager, research specialist at LCCC; Regina Antonini, director of special services p;rogram at LCCC, and Kenneth G. Kirk, Pensylvania Department of Education.

One of the main purposes of the joint planning effort, approved by the Pennsyslvania Department of Education, Bureau of Vocational and Adult Education, with funding from the Perkins Vocational Education Act of 1984, is to develop competency-based curricula. LCCC would develop programs so high school graduates without a technology background could also enroll in them.

Coordinating the project at LCCC is Wesley E. Franklin. Said Franklin, "This represents a major collaboration between the five technical schools and LCCC, establishing a model for joint planning between secondary and post-secondary educational institutions in the development of what is known as the '2 + '2 concept. This concept provides for instructional continuity between the first two years of a program offered at the secondary level and the next two years at the community college."

Recognizedd by the Pennsylvania Department of Education, Bureau of Vocational Education, as a unique, innovative approach, this synergistic effort will help to eliminate duplication of expensive advanced technololgy equipment, maximize the instructional resources of all participating institutions, and open new or expand existing channels of communication and cooperation between the vocational technical schools and LCCC.

"The directors of each vocational technical school were instrumental in the development of the project and provided essential impetus in involving members of their staffs," noted Franklin. "The project will also draw heavily on the expertise of local business and industry in establishing what technological tasks should be included in each program and what level of competency is acceptable for each."

Franklin concluded: "One of the primary reasons for creating such a project was the emphasis of the Pennsylvania Department of Education on program development in advanced technologies, supported by the very strong indicators in economic and industry data that the technologies included will be essential components of Northeastern Pennsylvania's future labor force."

For further information on the project, contact Franklin at 829-7380, or Nancy Kosteleba, director of the Center for Instructional Development at LCCC, at 829-7355.

ATTACHMENT #1

ATTACHMENT #2

LITERATURE SEARCH FOR LASER/ELECTRO-OPTICS

COMPETENCY-BASED CURRICULUM MATERIALS

DEVELOPMENT PROJECT

The laser/electro-optics curriculum offerings at the following colleges were reviewed by the laser technology task force.

| | |
|---|---|
| Laser/Electro-Optics Technology Program | Triton College<br>2000 Fifth Avenue<br>River Grove, Illinois 60171 |
| Laser/Electro-Optics Technology Program | Itawamba Junior College<br>653 Eason Boulevard<br>Tupelo, MS 38801 |
| Optical Fabrication and Testing Tech.<br>Laser/Electro-Optics Technology | Pikes Peak Community College<br>5675 South Academy Boulevard<br>Colorado Springs, CO 80906-5498 |
| Optical Engineering Technology Program | Monroe Community College<br>1000 East Henrietta Road<br>Rochester, N.Y. 14623 |
| Laser Technician Program | North Central Technical Institute<br>1000 Campus Drive<br>Wausau, Wisconsin 54401 |

The following materials were used to obtain additional information on laser technology programs.

Competency Based Curriculum Guide for Laser Technology, Fioroni, Illinois Vocational Curriculum Center

A Catalog of Performance Objectives and Performance Guides for Laser Systems Technician, V-TECS, July, 1984

Laser Technology Curriculum Materials from Center for Occupational Research and Development, 601 C Lake Air Drive, Waco, Texas 76710

SOURCE: ITAWAMBA JUNIOR COLLEGE, LASER/ELECTRO-OPTICS TECHNOLOGY PROGRAM OBJECTIVES, TUPELO, MS

RATE IMPORTANCE FROM 1 TO 5 WHERE 1=NONE AND 5=MAXIMUM

1 2 3 4 5

| Objective | RS | JZ | ZO | JH | JB | AVG |
|---|---|---|---|---|---|---|
| ____ 1. Troubleshoot and repair laser systems | 4 | 5 | 5 | 5 | 5 | 5 |
| ____ 2. Perform tests and measurements using electronic devices | 5 | 5 | 4 | 4 | 4 | 4 |
| ____ 3. Perform alignment procedures on optical systems, especially those which involve lasers and laser-related optics | 5 | 5 | 5 | 5 | 5 | 5 |
| ____ 4. Prepare and read shop drawings and schematics | 4 | 5 | 4 | 4 | 3 | 4 |
| ____ 5. Maintain a laboratory notebook, perform data reduction, and prepare reports | 5 | 3 | 3 | 3 | 1 | 3 |
| ____ 6. Operate interferometers, spectrometers, monochromators, and spectrophotometers | 5 | 3 | 3 | 4 | 2 | 3 |
| ____ 7. Operate laser systems, including intra-cavity modulation and Q-switching devices | 5 | 4 | 4 | 5 | 5 | 5 |
| ____ 8. Utilize basic laser and electrical safety practices in the laboratory | 5 | 5 | 5 | 5 | 3 | 4 |
| ____ 9. Perform optical inspection and cleaning of optical components | 5 | 5 | 5 | 5 | 4 | 5 |
| ____10. Operate and calibrate photodetectors, photomultipliers, optical power meters, and colorimeters | 4 | 5 | 4 | 4 | 3 | 4 |
| ____11. Select laser and optical components based on optical, electronic, and mechanical properties using manufacturer's catalogues and other trade publications | 2 | 3 | 3 | 4 | 2 | 3 |
| ____12. Troubleshoot and repair electro-optic devices and systems | 3 | 5 | 4 | 4 | 5 | 4 |

SOURCE: COMPETENCY BASED CURRICULUM GUIDE FOR LASER TECHNOLOGY, FIORONI, ILLINOIS VOCATIONAL CURRICULUM CENTER.

| | RATE IMPORTANCE FROM 1 TO 5 WHERE 1=NONE AND 5=MAXIMUM 1 2 3 4 5 | | | | | |
|---|---|---|---|---|---|---|
| | RS | JZ | ZO | JH | JB | AVG |
| ____ 1. Proficiency in algebra and trigonometry | 4 | 3 | 3 | 2 | 2 | 3 |
| ____ 2. Able to perform ray tracing through an optical system | 5 | 4 | 4 | 2 | 3 | 3 |
| ____ 3. Proficiency in assembly and disassembly of an optical system | 5 | 5 | 5 | 5 | 2 | 4 |
| ____ 4. Possession of a broad-based knowledge of electronics | 3 | 5 | 3 | 4 | 4 | 4 |
| ____ 5. Possession of a broad-based knowledge of optics | 4 | 5 | 3 | 4 | 3 | 4 |
| ____ 6. Has knowledge and skill to align lasers, optical systems, and associated electronic devices | 5 | 5 | 5 | 5 | 5 | 5 |
| ____ 7. Has the skill to hold these alignments to exacting tolerances | 5 | 5 | 5 | 5 | 5 | 5 |
| ____ 8. Has the knowledge to turn on and turn off a high power laser | 5 | 5 | 5 | 5 | 5 | 5 |
| ____ 9. Has the knowledge and skill to make repairs on a laser | 4 | 5 | 4 | 5 | 5 | 5 |
| ____10. Can make repairs on an optical system | 4 | 5 | 4 | 5 | 4 | 4 |
| ____11. Can repair associated electronic devices | 3 | 5 | 4 | 4 | 4 | 4 |
| ____12. Can clean optical devices without degrading surface quality | 5 | 5 | 4 | 5 | 5 | 5 |
| ____13. Can operate optical test equipment | 5 | 5 | 4 | 5 | 3 | 4 |
| ____14. Can operate electronic test equipment | 4 | 5 | 3 | 4 | 5 | 4 |
| ____15. Can analyze diagnostic test data to make repairs or adjustments on a system to bring it into specifications | 4 | 5 | 5 | 4 | 5 | 5 |
| ____16. Has a broad-based knowledge of electronics and optics as they relate to laser/electro-optical systems and their applications | 4 | 5 | 4 | 5 | 4 | 4 |
| ____17. Follows all safety procedures | 5 | 5 | 5 | 5 | 5 | 5 |

# LASER TECHNOLOGY
## TASK LIST

RATE IMPORTANCE
WHERE 1=NONE
AND 5=MAXIMUM
1 2 3 4 5

| MAINTAIN RECORDS | RS | JZ | ZO | JH | JB | AVG |
|---|---|---|---|---|---|---|
| ____ 1. Maintain a laboratory notebook | 5 | 3 | 4 | 2 | 1 | 3 |
| ____ 2. Prepare an operational log book/technical report | 3 | 3 | 3 | 3 | 3 | 3 |
| ____ 3. Prepare shop drawings | 2 | 3 | 2 | 2 | 1 | 3 |
| ____ 4. Prepare equipment requisition | 2 | 3 | 2 | 3 | 2 | 2 |
| ____ 5. Prepare service report | 2 | 3 | 5 | 4 | 5 | 4 |
| ____ 6. Prepare expense report | 2 | 3 | 0 | 4 | 5 | 3 |
| ____ 7. Update technical manual | 4 | 3 | 4 | 4 | 4 | 4 |
| **INSTALL LASER SYSTEM** | | | | | | |
| ____ 1. Install gaseous laser system | 4 | 4 | 3 | 5 | 5 | 4 |
| ____ 2. Install solid state laser system (YAG) | 4 | 4 | 3 | 5 | 5 | 4 |
| **MAINTAIN LASER SYSTEMS** | | | | | | |
| ____ 1. Inspect reflecting mirrors and focusing optics | 5 | 5 | 4 | 5 | 5 | 5 |
| ____ 2. Clean optics | 5 | 5 | 4 | 5 | 4 | 5 |
| ____ 3. Verify Q-switch in YAG laser system | 5 | 5 | 4 | 5 | 2 | 4 |
| ____ 4. Verify polarizer in YAG laser system | 5 | 5 | 4 | 5 | 2 | 4 |
| ____ 5. Test power/energy output at source | 5 | 5 | 4 | 5 | 5 | 5 |
| ____ 6. Verify thermal switch operation | 4 | 5 | 4 | 5 | 3 | 4 |
| ____ 7. Test RF power on Q-switch | 4 | 5 | 4 | 5 | 2 | 4 |
| ____ 8. Change water filter | 4 | 5 | 4 | 5 | 3 | 4 |
| ____ 9. Change deionizer cartridge holder/deionizer crtrdge | 4 | 5 | 4 | 5 | 3 | 4 |
| ____10. Adjust power supply output | 4 | 5 | 4 | 5 | 4 | 4 |
| ____11. Align complete beam delivery path/optics path/cavity optics | 5 | 5 | 4 | 5 | 5 | 5 |
| ____12. Inspect cooler fittings | 5 | 5 | 4 | 5 | 4 | 5 |
| ____13. Inspect air circulating filter | 4 | 5 | 4 | 5 | 4 | 4 |
| ____14. Clean air circulating filter | 4 | 5 | 4 | 5 | 4 | 4 |
| ____15. Replace air circulating filter | 4 | 5 | 4 | 5 | 4 | 4 |
| ____16. Measure power/energy output at source | 5 | 5 | 4 | 5 | 5 | 5 |
| ____17. Verify safety interlock system operation | 5 | 5 | 4 | 5 | 5 | 5 |
| ____18. Verify lens focal length | 5 | 5 | 4 | 5 | 1 | 4 |
| ____19. Verify repetition rate | 5 | 5 | 4 | 5 | 2 | 4 |
| **ANALYZE DOWN LASER SYSTEMS** | | | | | | |
| ____ 1. Identify symptoms of problem | 5 | 5 | 4 | 5 | 4 | 5 |
| ____ 2. Troubleshoot temperature control system | 5 | 5 | 4 | 5 | 4 | 5 |
| ____ 3. Troubleshoot beam generation system | 5 | 5 | 4 | 5 | 3 | 4 |
| ____ 4. Troubleshoot excitation system | 5 | 5 | 4 | 5 | 5 | 5 |
| ____ 5. Troubleshoot low voltate power supply | 5 | 5 | 4 | 5 | 4 | 5 |
| ____ 6. Troubleshoot RF system | 5 | 5 | 4 | 4 | 4 | 4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| ____ 7. Troubleshoot vacuum system | 5 | 5 | 4 | 4 | 4 | 4 |
| ____ 8. Troubleshoot gas supply system | 5 | 5 | 4 | 4 | 5 | 5 |

## REPAIR TEMPERATURE CONTROL SYSTEM

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| ____ 1. Replace cooler fittings | 3 | 5 | 4 | 4 | | 3 |
| ____ 2. Clean cooler fittings | 3 | 5 | 4 | 4 | | 3 |
| ____ 3. Recharge cooling system | 3 | 5 | 4 | 4 | | 3 |
| ____ 4. Replace temperature sensors | 3 | 5 | 4 | 4 | | 3 |
| ____ 5. Replace defective water pump | 3 | 5 | 4 | 4 | | 3 |
| ____ 6. Replace flow sensor/switch | 3 | 5 | 4 | 4 | | 3 |
| ____ 7. Repair defective wiring | 2 | 5 | 4 | 4 | | 3 |
| ____ 8. Replace defective hosing | 3 | 5 | 4 | 4 | | 3 |
| ____ 9. Replace heat exchanger | 2 | 5 | 4 | 4 | | 3 |
| ____10. Replace reservoir level switch | 2 | 5 | 4 | 4 | | 3 |
| ____11. Replace agitator | 2 | 5 | 4 | 4 | | 3 |
| ____12. Replace water solenoid | 2 | 5 | 4 | 4 | | 3 |

## REPAIR BEAM GENERATION SYSTEM

| | | | | | | |
|---|---|---|---|---|---|---|
| ____ 1. Replace crystal rod | 1 | 5 | 4 | 5 | 1 | 3 |
| ____ 2. Replace gaseous tube | 1 | 5 | 4 | 5 | 1 | 3 |
| ____ 3. Replace mirror | 2 | 5 | 4 | 5 | 3 | 4 |
| ____ 4. Replace gold cavity | 1 | 5 | 4 | 5 | 1 | 3 |
| ____ 5. Replace electrodes | 1 | 5 | 4 | 5 | 3 | 3 |
| ____ 6. Replace polarizer | 1 | 5 | 4 | 5 | 1 | 3 |
| ____ 7. Replace Q-switch | 1 | 5 | 4 | 5 | 1 | 3 |
| ____ 8. Repair beam expander | 2 | 5 | 4 | 5 | 5 | 4 |
| ____ 9. Replace mirror mount | 2 | 5 | 4 | 5 | 5 | 4 |
| ____10. Replace laser housing assembly | 1 | 5 | 4 | 5 | 5 | 4 |
| ____11. Replace flash lamp | 2 | 5 | 4 | 5 | 1 | 3 |
| ____12. Replace lamp jacket | 1 | 5 | 4 | 5 | 1 | 3 |
| ____13. Collimate beam expander | 3 | 5 | 4 | 5 | 4 | 4 |
| ____14. Verify peak pulse power | 3 | 5 | 4 | 5 | 5 | 4 |
| ____15. Verify frequency of pulse train | 3 | 5 | 4 | 5 | 4 | 4 |

## REPAIR EXCITATION SYSTEM

| | | | | | | |
|---|---|---|---|---|---|---|
| ____ 1. Replace high voltage capacitors | 1 | 5 | 4 | 4 | 4 | 3 |
| ____ 2. Replace high voltage diodes | 1 | 5 | 4 | 4 | 3 | 3 |
| ____ 3. Replace SCR (silicon control rectifier) | 1 | 5 | 4 | 4 | 4 | 3 |
| ____ 4. Replace defective board | 1 | 5 | 4 | 4 | 3 | 3 |
| ____ 5. Repair defective board | 1 | 5 | 4 | 4 | 4 | 3 |
| ____ 6. Replace high voltage cable | 1 | 5 | 4 | 5 | 4 | 4 |
| ____ 7. Replace defective resistors | 1 | 5 | 4 | 5 | 5 | 4 |
| ____ 8. Replace defective fuses | 1 | 5 | 4 | 5 | 5 | 4 |
| ____ 9. Replace three-phase contactor | 1 | 5 | 4 | 5 | 4 | 4 |
| ____10. Replace high voltage dump contactor | 1 | 5 | 4 | 5 | 4 | 4 |

REPAIR LOW VOLTAGE POWER SUPPLY

| | | | | | | |
|---|---|---|---|---|---|---|
| ____ 1. Replace capacitor | 1 | 5 | 4 | 4 | 5 | 4 |
| ____ 2. Replace diode | 1 | 5 | 4 | 4 | 3 | 3 |
| ____ 3. Replace low voltage power supply | 1 | 5 | 4 | 4 | 4 | 3 |
| ____ 4. Replace transformer | 1 | 5 | 4 | 4 | 3 | 3 |

REPAIR RF SYSTEM

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| ____ 1. Replace RF cable connector | 1 | 5 | 4 | 4 | | 3 |
| ____ 2. Replace RF driver | 1 | 5 | 4 | 4 | | 3 |

REPAIR VACUUM SYSTEM

| | | | | | | |
|---|---|---|---|---|---|---|
| ____ 1. Replace vacuum pump | 2 | 5 | 4 | 3 | | 3 |
| ____ 2. Replace vacuum hose | 2 | 5 | 4 | 3 | | 3 |
| ____ 3. Purge vacuum system-change vacuum pump oil | 2 | 5 | 4 | 3 | | 3 |

REPAIR GAS SUPPLY SYSTEM

| | | | | | | |
|---|---|---|---|---|---|---|
| ____ 1. Replace gas flow gauge | 2 | 5 | 4 | 4 | | 3 |
| ____ 2. Replace gas solenoid | 1 | 5 | 4 | 4 | | 3 |
| ____ 3. Repair gas leak | 1 | 5 | 4 | 4 | | 3 |
| ____ 4. Replace gas regulator-purge gas regulator | 1 | 5 | 4 | 3 | | 3 |

SOURCE: V-TECS, A CATALOG OF PERFORMANCE OBJECTIVES AND PERFORMANCE GUIDES FOR LASER SYSTEMS TECHNICIAN, JULY, 1984

## SECTION VII

## SAMPLE TASK FORCE LETTERS

# HAZLETON AREA VOCATIONAL-TECHNICAL SCHOOL

*23rd & McKinley Streets*
*Hazleton, Pa. 18201-1597*

DANIEL C. PARRELL
*Superintendent of Schools*

DALE H. LONG
*Director*

June 18, 1987

Mr. Wesley E. Franklin
Director, BIE Partnership
Luzerne County Community College
Prospect Street and Middle Road
Nanticoke, PA 18634

Dear Mr. Franklin:

My involvement with the C.I.M. Task Force has been an enjoyable one. It is very pleasing to know that the Luzerne County Community College is making a very positive effort to bring a taste of Advanced Technology to the area.

I have been involved with High-Tech Manufacturing for the last nine years and I can see the need for well trained High-Tech people.

I feel that we have put forth a very well-balanced Competency-Based curriculum. All of the materials were gone over again and again in order to maintain the best possible course of study.

The meetings along with the educational trips were most important in order to meet our goal.

I would feel honored to be involved with the Advanced Technology Center in any way, whether it be in curriculum development, as a machine purchasing consultant, or on the instructional end.

Finally the people who were in charge of each committee acted in a very hospitable, professional manner.

Hope to see you in the fall.

Yours truly,

Leonard J. Tarapchak

Leonard J. Tarapchak

LACKAWANNA COUNTY AREA VOCATIONAL-TECHNICAL SCHOOL

CHARLES G. THOMAS
Assistant Director
Dr. Peter M. Mensky Center
Old Plank Road
Mayfield, Pennsylvania 18433
282-6700 or 876-4061

ROBERT D. MUZZI
Administrative Director
3201 Rockwell Avenue
Scranton, Pennsylvania 18508
(717) 346-5955

ARTHUR M. LUCARELLI
Assistant Director
Henry J. Dende Center
3201 Rockwell Avenue
Scranton, Pennsylvania 18508
Main Office 346-8471
Practical Nursing 346-8728

June 16, 1987

Mr. Wesley E. Franklin
Luzerne County Community College
Prospect and Middle Road
Nanticoke, Pa. 18634

Re: Robotics/Automated System Task Force

Dear Wes:

I would like to express my thanks for letting me be a part of your task force. I hoped my participation helped you meet your goals. In my opinion we came a long way.

After we got past the preliminaries concerning CBE definitions and activities we had solid direction for our own activities. I must commend Libby on her thorough research of related materials and the timely presentation of same. The material was very appropriate and certainly not lacking in quantity. Libby did an excellent job on the competency verification. The visit to Lancaster Vo-Tech and Harrisburg Community College along with Dave Rohm's presentation was extremely helpful as it related to equipment needs, interactive problems between the two institutions and problems related to the academic section.

We are at a point now where specific goals can be established within a determined time line. Meetings should be held to meet these goals which at this time could be more often than in the past.

I will be glad to participate next year if the need arises. The project which included needs determination and curriculum content certainly is required before program implementation. There certainly is a need for continuation of this project.

I would like to add the following comments and/or suggestions:

1. The 2 + 2 concept sounded good initially, however, as time went on it became obvious it is not practical at L.C.C.C. or A.V.T.S. level.

2. The task force is at a point where Dr. McQuay's work is required. Emphasis should be placed on his completing the draft copy of the entire curriculum.

3. The establishing of new course(s) should be considered. Assuming a course can automatically apply to a program is not accurate.

Example: Why does a robotics technician need to have knowledge of drafting techniques and occupations when a Sketching/Blueprint Reading Course will suffice? The depth of the Industrial Process courses is also questionable.

4. L.C.C.C. and the A.V.T.S. should develop a joint effort to change the image of vocational education. This I know influences your enrollments as well as ours. Prime target should be guidance staff.

Again I thank you for the opportunity to have input.

Sincerely,

Ben Rondomanski

Ben Rondomanski
Supervisor of Voc. Ed.

BR/cn
cc: E. Yeager

# West Side Area Vocational-Technical School

75 EVANS STREET
PRINGLE BOROUGH
**KINGSTON, PENNSYLVANIA 18704-1899**
**PHONE: 717-288-8493**

Member School Districts:
NORTHWEST AREA
LAKE-LEHMAN
DALLAS
WYOMING AREA
WYOMING VALLEY WEST
And Services to:
GREATER WILKES-BARRE AREA

Administrative Director
GEORGE W. PYLE
Principal
THOMAS F. FEENEY
Business Manager
BRUCE W. GERMAN
Data Processing Services Manager
ROBERT D. POWELL


June 10, 1987

Mr. Wesley E. Franklin
Curriculum Materials Development Task Force
Luzerne County Community College
Prospect & Middle Roads
Nanticoke, PA 18643

Dear Wes:

I understand you will be writing the final report soon on "our" project. What a good idea to get input from area vocational-technical high school teachers before setting up your new technology center. Who is better able to tell you what is needed in regard to classrooms, equipment, shops, students, courses, etc. Hopefully, I have been of some help. I also think it was a good idea to visit vocational-technical schools in other areas of the state to see how they were coping with the new technologies.

Northeastern Pennsylvania needs this center badly. We need it to induce new industry to our area, so our young people don't have to leave to find a decent job. We in the vocational high schools need it to induce college-bound students to attend our school, to help dispel the myth that vocational students don't go to college.

Please contact me if I can be of any further assistance. The success of this center is important; not only to the college but to all of us who live in this area.

Sincerely yours,

Kathy Heltzel

Kathy M. Heltzel, Instructor
Data Processing

KMH/kk



*"He who hath a trade, hath an estate"**
* *Attributed to Benjamin Franklin*

WILKES-BARRE AREA VOCATIONAL-TECHNICAL SCHOOL

P.O. Box 1699 North End Station
Jumper Road, R.D. 2 Plains Township
Wilkes-Barre, Pennsylvania 18705
[717] 822-4131

GEORGE T. YANIK, CHAIRMAN
JOINT OPERATING COMMITTEE

ROBERT G. ELIAS
ADMINISTRATIVE DIRECTOR

LEO E. SOLOMON
CHIEF SCHOOL ADMINISTRATOR

June 10, 1987

Mr. Wes Franklin
Luzerne Community College
Nanticoke, Pa. 18634

Dear Sir,

It has indeed been a pleasure to serve on your Curriculum Committee for the new High Tech Center which is being constructed at the college.

The materials covered were extensive, well prepared and presented in a manner which was in the best of everyone's interest.

The days and times of the meetings were always agreed to so that everyone could attend without any hardships incurred.

I believe much was accomplished and look forward to more productive meetings in the future.

Yours Truly,

Al Grabowski

Al Grabowski,
Wilkes-Barre Area Vo-Tech
Adult Evening Coordinator