This publication identifies exemplary programs and human resources in the automated manufacturing technologies. Its purpose is to assist vocational education program planners and curriculum specialists in updating programs and staff skills to prepare for high technology. Chapter 1 is an introduction. Chapter 2 describes the seven U.S. Secretary of Education's exemplary programs in narrative form. Program name, institution, and the institution's location are highlighted at the beginning of each entry. The program description follows. Contact information, including mailing address and telephone number, is highlighted at the end. Chapter 3 presents in a graphic format exemplary programs identified in a nationwide survey. Programs represent 18 technical areas: avionics, biomedical equipment technology, computer-aided design and drafting, computer-aided manufacturing, computer engineering technology, computer numerical control, electrical technology, electronics technology, electromechanical technology, graphics technology, industrial optics, laser technology, mechanical engineering technology, process control and instrumentation technology, robotics, semiconductor technology, solar technology, and telecommunications. A heading at the top of each page identifies the area. Information presented in box-form includes program title, contact information, including mailing address and telephone number; whether assistance is available; whether a syllabus is available; whether the program is competency-based; start date; and a narrative program description. (YLB)
PREPARING FOR
HIGH TECHNOLOGY

MODEL PROGRAMS IN THE USA
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- Generating knowledge through research
- Developing educational programs and products
- Evaluating individual program needs and outcomes
- Providing information for national planning and policy
- Installing educational programs and products
- Operating information systems and services
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PREPARING FOR HIGH TECHNOLOGY:
MODEL PROGRAMS IN THE USA

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FOREWORD

Preparing for High Technology Model Programs in the USA provides information for vocational educators to use in developing or updating programs related to automated manufacturing technologies. Its primary purpose is to assist program planners and curriculum specialists in their effort to update programs and staff skills to prepare for high technology by making available information about exemplary programs currently in existence in these areas. Program planners and curriculum specialists can then build on the experience and expertise of others in preparing for high technology.

The profession is indebted to Dr. Charles R. Doty for his scholarship in preparing this guide. Dr. Doty is Associate Professor in the Department of Vocational and Technical Education at Rutgers—The State University of New Jersey. Dr. Doty was assisted in preparing the guide by Carolyn DeCastro, Associate Director, Community Service Programs, and Xavier F. Gonzalez, Chair, Electronics Engineering Technology, County College of Morris, Randolph, New Jersey, and Jack Waintraub, Chair, Department of Electrical Engineering Technology, Middlesex County College, Edison, New Jersey. Martha Pocsi, Director, and Dr. Myron Corman, Curriculum Specialist, of the Northeast Network for Curriculum Coordination assisted by providing electronic database searches.

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Robert E. Taylor
Executive Director
The National Center for Research in Vocational Education
CHAPTER 1. INTRODUCTION

A Second Industrial Revolution

Automation has been a familiar part of American manufacturing processes for over a century. Indeed, since the Industrial Revolution of the 19th century, we have come to measure the modernity of an industry by the extent to which work in it is mechanized. The most familiar phenomenon of mechanization has been the assembly line—a conveyance system along which strategically situated workers perform routine, repetitive tasks on items passing by.

Today, a second industrial revolution is occurring as a new wave of automation affects manufacturing processes. This new wave of automation—the high technology of the 1980s—is affecting many more industries than did its predecessor a century ago. To be sure, high technology is making itself felt in manufacturing processes, more and more, robots are taking over the routine, repetitive assembly-line tasks traditionally performed by workers in manufacturing. Robotics, however, is only one part of the high-technology revolution affecting the American workplace.

Perhaps the best known piece of high technology in the workplace today is the computer, which is revolutionizing work processes in many nonmanufacturing occupations. Computers monitor sophisticated biomedical equipment in hospitals and health care facilities, the "drawing board" is obsolescent with the advent of computer-aided design and drafting, computer numerical control systems perform many precision manufacturing operations.

Finally, the impact of high technology is not limited to robotics and computers. A list of high-technology occupations in the 1980s would include avionics, electronics, laser technology, solar technology, telecommunications, process control and instrumentation, graphics, and many others. The high-technology industrial revolution is changing existing occupations and creating new ones at a faster rate than ever before.

What Is High Technology?

High technology can be defined in different ways for different purposes. The Bureau of Labor Statistics, for example, suggests that a high-technology organization is one that spends 10 percent or more of its revenues on research and development and that has a high proportion of scientists, engineers, and technicians among its employees ("High Technology Terms Defined" 1983). Along this vein, Ives's hypothetical construct of technical-scientific employment (1975, p. 24) depicts the overlapping operations and responsibilities of scientists and technicians in such organizations.

Levin (1984), on the other hand, equates high technology with the current revolution in the development and use of computers, lasers, communications, information, production technology, biochemistry, and microbiology. And just as the emergence of work specialization and automation is considered a characteristic of the 19th-century Industrial Revolution (Carnevale 1984), so does the high-technology revolution have a large component of automation today. Lemons (1984, pp. 7-8) refers collectively to seven programmable automation technologies as "high technology" robot-
ics, computer-aided design, computer-aided manufacturing, computer-aided process planning automated materials handling, and automated storage and retrieval systems

Such niceties of definition aside, this publication focuses on the high technology of automated manufacturing processes. Change is occurring at a particularly rapid pace in today's automated manufacturing technologies as new machinery, equipment, and processes are put into place, creating new job positions and eliminating old ones overnight. The rapidity with which change is occurring in these technologies offers particular challenges to vocational educators.

Implications for Vocational Education

Vocational educators have been quick to recognize the scope and impact of technological change in the American workplace (Abram et al. 1982), they have been especially concerned with the impact on training programs that prepare workers for the world of work today. Because rapidly changing technology can quickly outdate technicians' skills, for example, Roney (1983) suggests that the content of high-technology programs should include both principles that are universal, unchanging, and transferable and a specialized technology application.

Furthermore, fast-paced technological change can outdate teachers' technical knowledge and skills as well. Alfred and Nash (1984) note the emerging need to retrain or revitalize the faculty in public community college career programs. Nelson (1979) remarks that "faculty development will be more important than ever in the 1980's" (p. 143). Kotula (1976), in fact, points out that 3 percent of an institution's total budget should be spent on staff development and curriculum development.

Various research efforts have been undertaken by the National Center for Research in Vocational Education to identify the "state of the art" today in faculty development and upgrading. Long and Warmbrod (1982) identify various sources of funding for programmatic responses to technological change: State education agencies, foundations, business and industry, and institutional budgets. Wonacott and Hamilton (1983) found six basic delivery techniques in use to update teachers' technological knowledge and skills (work experience internships; university and college course work; workshops, conferences, and seminars; industry observation, education and industry staff exchange, and part-time employment). Warmbrod, Avich, and L'Angeille (1981) describe four model "return-to-industry" programs operated by community colleges.

Likewise, Hamilton and Wonacott (1984) undertook research into the essential characteristics of successful programs to update teachers' technological knowledge and skills. They identified nine such characteristics that, taken together, constitute a generic strategy for vocational educators to follow in planning and implementing update programs for secondary and postsecondary teachers and instructors.

The Need for Curriculum Resources

In spite of the considerable body of knowledge on effective methodologies for updating teachers' and instructors' technological knowledge and skills, there exists another large area of need among vocational educators. Once teachers and instructors have participated in knowledge and skill update activities, they must still update their program curricula. It is vital that students receive training that reflects the state of the art in their occupational technologies.
One excellent approach to updating curricula for automated manufacturing technologies programs is to build on the experience and expertise of others in implementing such programs. This publication was compiled to identify exemplary programs and human resources in the automated manufacturing technologies. Chapters 2 and 3 consist entirely of entries for the exemplary programs. Each entry includes contact information and a narrative description of the program. Two different means were used to identify the exemplary programs described in this publication.

Secretary of Education's Exemplary Programs

In 1981, the U.S. Secretary of Education initiated an awards program in which 1 vocational education program in each of the U.S. Department of Education's 10 regions is designated as exemplary each year. These awards are made only to programs that demonstrate a broad-based enrollment, are in compliance with civil rights statutes, and have been operational at least 1 year. Ten additional criteria are used in the selection process; such program characteristics as stated objectives, demonstrated progress toward stated objectives, instructional equipment and facilities that complement stated objectives, community involvement, a high job-placement rate, and prior program recognition or publicity are scrutinized in the selection process.

Since the first awards in 1981, a number of automated manufacturing technologies programs have been designated as exemplary by the Secretary of Education. Descriptions of these programs, which have been disseminated by the Office of Vocational and Adult Education of the U.S. Department of Education, are presented in chapter 2.

Nationwide Survey of Exemplary Programs

Additional exemplary programs in automated manufacturing technologies were identified through a survey of the States and Territories. State-level administrators of higher education nominated exemplary automated manufacturing technologies programs operated by community colleges and technical institutes in their States or Territories. Staffs of nominated programs were asked to provide program descriptions. Programs for which this information was obtained are included in chapter 3 and represent the following technical areas:

- Avionics
- Biomedical equipment technology
- Computer-aided design and drafting
- Computer-aided manufacturing
- Computer engineering technology
- Computer numerical control
- Electrical technology
- Electronics technology
- Electromechanical technology
- Graphics technology
- Industrial optics
- Laser technology
- Mechanical engineering technology
- Process control and instrumentation technology
- Robotics
- Semiconductor technology
- Solar technology
- Telecommunications
How to Use this Publication

Each of the two kinds of exemplary programs presented in this publication is described in a standard format. The U.S. Secretary of Education's Exemplary Programs appear in chapter 2 in basically narrative form. The name of the program, the institution at which it is located, and the institution's location are highlighted at the beginning of each entry. Contact information, including mailing address and telephone number, is similarly highlighted at the end of each entry.

The programs identified in the nationwide survey are presented in a consistent graphic format in chapter 3. As shown in figure 1, a heading at the top of each page identifies the technological area that the program represents. The program title appears in the box at the top of the entry, contact information, including mailing address and telephone number, appears in the box immediately below. Four small boxes appear below the contact information; these indicate whether assistance is available, whether a syllabus is available, whether the program is competency based, and when the program was started. Finally, each entry presents a narrative description of the program in the large box at the bottom of the page.

Figure 1. Nationwide exemplary program description format
CHAPTER 2. SECRETARY’S EXEMPLARY PROGRAMS

Industrial Electricity and Electronics Program
St. Johnsbury Academy
St. Johnsbury, Vermont

In the school year prior to its selection, the Industrial Electricity and Electronics Program served 44 students—3 female and 41 male. An open-entry/open-exit referral concept allows both vocational and college-bound students to take optimal advantage of the program. Students are referred by and transported from their sending schools for half-day vocational instruction that is delivered through the use of individualized behavioral objectives. Sixty-one percent of completers go on to higher education institutions, 23 percent accept employment in program-related work, and 10 percent go into military service. Of those completers immediately available for employment, 75 percent are placed in jobs by program staff.

The program has been adopted, with adaptations, in other area vocational centers in the State. The open-entry/open-exit concept enables the instructor to serve many more students than would be possible in a traditional program. Students are allowed to work at their own rate and receive credit only for competencies demonstrated above their clearly defined individual minimum standards. Reference materials and equipment are available to students when they need to use them. Students learn how to learn and to challenge themselves on their own while they are acquiring marketable skills.

The reputation of the graduates of the program with employers is excellent. Employers consistently give very high ratings to the program and its completers whom they employ.

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St. Johnsbury, VT 05817
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Drafting and Design Technology Program
Okeechobee-Walton Junior College
Niceville, Florida

The Drafting and Design Technology Program for freshmen and sophomores served 113 students—30 female and 83 male—during the year of its selection. It prepares students for careers in drafting and computer-aided design and drafting. In addition to providing job preparatory training, the program offers updating training for employed technicians in the field and job retraining.
for adults whose job skills have become obsolete due to advances in technology. It offers both the associate of science degree and technical certificates.

During the past 8 years, the Drafting and Design Technology Program has been emulated by other institutions in 38 States and 2 foreign countries. Some of the areas of the program that have generated particular interest are placement and follow-up, computer-aided design and drafting training, and students with special needs (i.e., displaced homemakers, minorities, handicapped, and disadvantaged).

The program maintains a 92 percent successful placement record, and its placement and follow-up model is being used throughout the State of Florida. Graduates of the program hold more than 100 of the approximately 138 drafting positions in Okaloosa County, and other graduates have been placed in more than 50 cities throughout the country.

The program maintains a cooperative agreement with local industry so that all students who have not had previous working experience can complete a one-semester internship on the job before graduation.

The major objectives of the program are as follows:

- Prepare adults for responsible, rewarding careers as drafting and computer-aided drafting technicians.
- Deliver high-quality technical updating training for employed drafters, designers, engineers, architects, and drafting teachers.
- Retrain adults whose job skills have become obsolete due to advances in technology or who wish to make a midcareer change.
- Serve as a "model" vocational-technical program that can be emulated by other programs through the United States.

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Computer-aided Design/Computer-aided Manufacturing (CAD/CAM) Program
Elgin Community College
Elgin, Illinois

The Computer-aided Design/Computer-aided Manufacturing (CAD/CAM) Program is a partnership between industry and education. Annually, it serves approximately 400-500 students, about two-thirds of whom are men and one-third women.
The program began in 1979 when a private sector firm offered its facilities and equipment to 15 drafting and design students from Elgin Community College. The Saturday morning classes were taught by the director of a major division of the firm, and each course was oversubscribed by at least 15 students. At that time, many large firms were having trouble finding well-trained personnel to operate their systems, and they recognized that only through the training of competent technologists could that need be met. Consequently, a major equipment manufacturer donated a complete CAD system.

In March 1981, the college’s industrial technology staff prepared a proposal to involve industry, and in-depth interviews were conducted with area industrial leaders and professional organizations, as well as with the college’s industrial leaders and technology staff and advisory councils. In order to demonstrate their support, area manufacturers and the Society of Manufacturing Engineers (SME) donated funds toward the purchase of a CAM system. The college’s CAD/CAM advisory committee, representing management of 15 area industries, unanimously agreed that the CAM system would meet their organizations’ needs. Furthermore, the more than 125 companies that had sent representatives to the college’s CAD seminars, workshops, and demonstrations agreed to send their employees for CAD training at the college. As a result, Elgin Community College now offers an associate degree in both CAD and CAM. Also, it offers short seminars and workshops in CAD/CAM operations. Those involved in making this training possible include 30 employed engineers, designers, drafters, and technicians, and full-time college engineering and technology students.

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Graphic Arts Technology Program
Central Maine Vocational Technical Institute
Auburn, Maine

There are approximately 300 industries in Maine that employ graphic arts technology personnel. Many of these are small establishments that employ 30 or fewer people, or larger ones that seldom employ more than 100.

Central Maine Vocational Technical Institute’s Graphic Arts Program is the only postsecondary offering in the State, and job opportunities requiring formal training far exceed the annual number of graduates. For example, during the 1981-82 school year, 106 job openings, about 75 percent of which required formal training, were posted on the institute’s active job list. Twenty of these positions were filled by the institute’s graduates and four by institute students with some training.

During the year of the program’s selection, 51 students were enrolled in the program—22 males and 29 females. There were 22 graduates. The program is a comprehensive 2-year sequence of training activities that prepares students for employment in all phases of the printing industry in such positions as press operator, copy layout technician, and phototypesetter. Training includes...
theory, application, and an internship of 1,500 hours of paid employment, the latter offered during the second year of training. Students have the option of earning a certificate, a diploma, or an associate degree.

Throughout the 2 years, students are encouraged to perform by industry standards. This means that attention is focused on three priorities: quality of work, care of equipment, and production.

The 14-member occupational advisory committee offers much guidance to the program. Permanent members of the committee are the chairman of the Graphic Arts Technology Department and three faculty members. They work closely with the State graphic arts trade association and choose 9 representatives from industry for 3-year terms.

Present representatives from industry include wide diversification both in employment and in geographic location. Included are skilled graphic arts workers in small- or medium-sized industries, sales representatives or general managers of larger industries, and the owners of small establishments.

The student representative, who must be in the second year of training, is elected each year by the students. Thus, the trainees, the trainers, and the potential future employers are all represented on the advisory committee.

Regardless of the graphic arts specialty and regardless of the preference for employment in a small or large industry or in a business of one's own, graduates of the institute's graphic arts program have found their way into economic productivity. A few examples are as follows:

- A graduate took a job at a small industry that employed about 20 employees. His job was in stripping image assembly work—the organizing of film material for press plate. He is now a key employee of that establishment.
- A graduate now owns and operates a small industry with the help of 2 other members of her family.
- A graduate now owns his own firm and employs about 10 other persons.
- A graduate who specialized in copy preparation is now a phototypesetting supervisor of about 12 employees. She is one of that industry's 100 or more employees.
- A graduate now owns his own business and employs about 20 people.

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Training Opportunities Program (TOP)
New York City Board of Education
Brooklyn, New York

The New York City Public Schools have expanded and strengthened linkages with the private sector through its Training Opportunities Program (TOP). More than 250 small- and medium-sized businesses participate in the program and pay 50 percent of the student training costs.

The primary focus is for 21 high schools in all 5 boroughs of New York City to work with a variety of businesses, to utilize facilities, equipment, and human resources not readily available at the local high school, and to provide expanding opportunities for women and minorities.

Students are selected on a wide range of criteria such as interest, experience, occupational goals, handicapping conditions, limited-English-speaking ability, and interest in nontraditional careers. TOP exposes students to the real world of work and reinforces the natural partnership between school and work.

A survey of the outcomes of the program included such data as the following:

- Eighty-two to 98 percent of the employers rated trainees’ performance on the job as adequate or more than adequate.
- Sixty-two percent of the employers indicated that the trainee performed better than expected.

Ninety-one percent said they would be willing to accept another trainee next year.

- More than 86 percent of the trainees stated that they benefitted from participating in the program.
- More than three-fourths of the establishments indicated that they would employ TOP trainees after the training period ended and cited the trainees’ good performance as the reason.
- Two-thirds of the trainees had the opportunity to work with equipment not available at school, particularly high-technology equipment.
- Major benefits to trainees were increased knowledge and experience and the learning of good work habits and skills in career decision making.

The target group of the program is in-school youth in grades 11 and 12, from 16 to 21 years of age.

The 1982 program addressed two main priorities: youth employment and economic development. A total of 374 students (332 females and 542 males) participated in the program. Of that number, 43 percent were black and 35 percent were Hispanic. Handicapped students represented 6 percent of the total. Of those enrolled in the program, more than half were from homes in which the annual income was under $10,000; 90 percent of the students came from homes in which the annual income was under $20,000. Thus, being prepared for a job and becoming employed were necessities for many of the 243 graduating seniors in the 1982 program; 48 percent became gainfully employed, and 45 percent enrolled in institutions of higher learning. The program began in 1981, and by March 1983 a total of 1,136 students had actually received training. Some students...
train in an alternate-week mode—1 week of work and 1 week of school—but most students receive
training on a part-time basis after school or full-time weekend basis. Students may receive training
in such occupations as these

- Data processing
- Optical technology
- Climate control
- Drafting
- Printing
- Auto diagnostics
- Security systems
- Small animal care
- Health
- Graphic arts
- Electronic technology repair

For further information contact:

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New York City Board of Education
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Brooklyn, NY 11201
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Laser Technician Program
North Central Technical Institute
Wausau, Wisconsin

When North Central Technical Institute's Laser Technician Program was initially proposed,
only three programs of its kind were operating in the Nation. Its 2-year postsecondary program,
approved by the State board in the fall of 1977, began operating in 1973. At that time there were
only four other programs in the United States. It is still the only public training program for laser
technicians in Wisconsin.

Of the graduates working in related employment, 48 percent work in the North Central Tech-
nical Institute District, 34 percent elsewhere in Wisconsin, and 18 percent out of State. There were
about 75 enrolled in the 1982 full-time program and 20 in the elective courses in the evening pro-
gram. There were 34 graduates.

The objectives of this program are as follows

- To provide a formal education program in laser technology leading to an associate degree
- To provide students with the knowledge, skills, and experience necessary to obtain
  employment as a laser systems technician
- To provide a prepared work force needed to meet the rapidly increasing demand for
  trained technicians in the field of laser technology
To provide a program for presently employed technicians to upgrade their skills for advancement on the job by offering a continuing education program.

An introduction to lasers is covered in the first semester's key course. It provides the theory of all lasers, compares the design and properties of each, and teaches how to measure the characteristics of the laser output and how to clean and align laser mirrors. The key course in the second semester covers laser optics, which includes both geometric and wave optics theory and the application of the theory to optical components used in lasers.

Lasers and electro-optics equipment are addressed in the third semester's key course. Students work with medium- and high-power lasers, applying the theory learned in the first two semesters to a variety of lasers and measuring instruments. The fourth semester key course addresses laser application projects in which there are 6 hours of lab time for every hour of lecture.

The curriculum includes much hands-on experience working with a variety of types of lasers located in a specially designed facility that incorporates seven different lab areas as well as a lecture room.

As the result of several noncredit public information courses, local industries have become involved with laser applications. Student projects are often coordinated with the research needs of outside agencies such as local industry, business, and medical groups. Recently, a carbon dioxide laser head and power supply, worth about $35,000, were donated to the institute. The gift was arranged by a Laser Technician Program graduate who is now employed by the donating industry.

For further information contact:

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Public Information Coordinator
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Irrigation Technology Program
Walla Walla Community College
Walla Walla, Washington

The Irrigation Technology Program was initiated at Walla Walla Community College in the fall of 1977. Students spend two quarters on campus in training in the classroom, and during spring and summer quarters they are employed in cooperative training jobs. After the cooperative training experience, students return to campus for two more quarters of training in the classroom. After the successful completion of six quarters, students are eligible for graduation with an associate of applied arts and sciences degree in irrigation technology.

During the 1983 winter quarter, 25 full-time students were enrolled in irrigation technology, and 8 students had already paid a deposit to reserve a place in the September 1983 class. In order to ensure that students possess the basic skills required for the program, students are screened in algebra and reading. Those who need additional help with basic skills are then directed to compensatory education classes to make up the deficiencies.
The purpose of the program is to train students to install, service, maintain, and repair sprinkler irrigation systems, particularly center pivot systems. Instruction includes electricity and basic wiring and center pivot troubleshooting, as well as sources and application of irrigation water and soil-water-land relationships. It also includes blueprint reading, business and personnel management, and surveying.

Student progress is assessed regularly both in the classroom activities and in the cooperative training sessions. Students who graduate from the program take with them a resume of actual work experience, and they build employment references while enrolled in the program.

The on-campus classroom and laboratory consist of approximately 1,506 square feet. This area includes student work tables, work benches, and shop space for project work. There is also a two-tower center pivot system installed on campus that was donated by a local manufacturer.

Work during the cooperative training experience is defined in a training agreement that focuses on the learning objectives of each student to ensure against work exploitation. Students keep weekly records of work and learning experiences. A seminar class is held concurrently with the cooperative training time period. This provides an opportunity for students and employers to discuss experiences that students have had in their job training.

The private sector is much involved in the program through representatives serving on the advisory committee, through the hiring of cooperative training students, and through donating of supplies and equipment. The instructor is in constant contact with local businesses to seek cooperative training positions for students.

During the 2 years prior to the program's selection, 100 percent of the students who completed the program were employed, 85 percent of them in the irrigation industry. When they completed training, most students have a choice of jobs. Employers call the college seeking employees. In addition to being employed locally, students have found employment in other states—Oregon, New Mexico, and Nebraska—and in foreign countries. There is a particular demand for irrigation technicians in Saudi Arabia.

For further information contact:

James R. Peterson
Director
Occupational Education
Walla Walla Community College
500 Tausick Way
Walla Walla, WA 99362
(509) 527-4215
CHAPTER 3. NATIONWIDE EXEMPLARY PROGRAMS

PROGRAM
Avionics Technician

CONTACT
Goesta Schmidt
Instructor
South Seattle Community College
6000 5th Avenue SW
Seattle, WA 98106
(206) 764-5394

ASSISTANCE AVAILABLE
Yes

SYLLABUS AVAILABLE
Yes

START DATE
1975

COMPETENCY BASED
Yes

PROGRAM DESCRIPTION
The Avionics (Aviation Electronics) Technician Program is a specialized 2-year (6 quarter) training program offering contemporary technology instructional curriculum both in theory and practice. The avionic technician curriculum prepares students to qualify for the Federal Communication Commission (FCC) general class radiotelephone licensing requirements. Associate of applied science degree requirements are as follows:

Technical Specialty Courses

<table>
<thead>
<tr>
<th>Number</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT 160</td>
<td>Fundamentals of Electronics</td>
<td>8</td>
</tr>
<tr>
<td>INT 161</td>
<td>Amplifiers and Oscillators Communication Systems</td>
<td>8</td>
</tr>
<tr>
<td>INT 163</td>
<td>Programming for Electronic Technicians</td>
<td>8</td>
</tr>
<tr>
<td>INT 116-19</td>
<td>Introduction to Avionics</td>
<td>4</td>
</tr>
<tr>
<td>AVT 264</td>
<td>Intermediate Avionics</td>
<td>9</td>
</tr>
<tr>
<td>AVT 266</td>
<td>Advanced Avionic Systems</td>
<td>10</td>
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<tr>
<td>AVT 268</td>
<td></td>
<td>57</td>
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### Allied Supporting Classes

<table>
<thead>
<tr>
<th>Number</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MAT 111-13</td>
<td>Technical Math</td>
<td>12</td>
</tr>
<tr>
<td>PHY 101-03</td>
<td>General Physics</td>
<td>15</td>
</tr>
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<td></td>
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### General Education Courses

<table>
<thead>
<tr>
<th>Number</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG 101-02</td>
<td>Composition</td>
<td>6</td>
</tr>
<tr>
<td>ENG 108</td>
<td>Technical Report Writing</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>General Education Electives (must include one course in social science)</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>102</strong></td>
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</table>

*Continued*
The Biomedical Equipment Technology Program prepares graduates for employment as electronic technicians in the health care field. The program has a strong electronics base with extensive course work in anatomy, physiology, and the social sciences. The CSEL (college-sponsored experiential learning) experience is an integral part of the program with students placed in hospitals, extended care facilities, and service bureaus for on-site training. The program is articulated with the local secondary vocational system and two local institutions of higher education. An associate of applied science degree is awarded at the completion of the program.

Technical assistance available:

- Additional information about the program
- Consultants for proposal preparation, curriculum development, program review, and equipment selection
Instrumentation is being used increasingly in medical, biological and research fields. This equipment has become so complex that technicians must have a detailed knowledge of biomedical procedures and biomedical terminology so that proper functioning of the equipment and safety of the patient can be assured. The program provides the general technical knowledge and understanding of the more commonly used biomedical instruments, components, systems, and circuit techniques. The degree of associate in science in biomedical instrumentation technology will be awarded after successful completion of the program requirements.

### SEMESTER 1

<table>
<thead>
<tr>
<th>Number</th>
<th>Course Title</th>
<th>Class</th>
<th>Lab</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE 100</td>
<td>English Composition</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective Humanities</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EB 120</td>
<td>Measuring Principles</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>ET 110</td>
<td>Basic Electronics</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ET 115</td>
<td>Electronics Lab</td>
<td>4</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>MM 101</td>
<td>Mathematics</td>
<td>1</td>
<td></td>
<td>1</td>
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<tr>
<td>MM 102</td>
<td>Mathematics</td>
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<td>1</td>
</tr>
<tr>
<td>MM 103</td>
<td>Mathematics</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>MM 231</td>
<td>Engineering Computations</td>
<td>1</td>
<td></td>
<td>1</td>
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<tr>
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<td>15</td>
<td>7</td>
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### SEMESTER 2

<table>
<thead>
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<th>Class</th>
<th>Lab</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE 200</td>
<td>Comp 2 Intro to Lit</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>EB 230</td>
<td>Measuring Principles</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ET 210</td>
<td>Basic Electronics</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>ET 220</td>
<td>Active Networks</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>ET 215</td>
<td>Electronics Lab</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>MC 100</td>
<td>Chemistry 1</td>
<td>3</td>
<td>4</td>
<td>4</td>
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<td></td>
<td></td>
<td>14</td>
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### SEMESTER 3

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<thead>
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<th>Number</th>
<th>Course Title</th>
<th>Class</th>
<th>Lab</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE 202</td>
<td>Technical Report Writing (or)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>LE 203</td>
<td>Fundamentals of Speech</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>EB 320</td>
<td>Calibration &amp; Standardiz</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>EB 340</td>
<td>Electronic Circuits</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>ET 340</td>
<td>Comp Architecture and Logic Circuitry</td>
<td>3</td>
<td>4</td>
<td>2</td>
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<tr>
<td>ET 350</td>
<td>Humanities Elective</td>
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### SEMESTER 4

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<th>Course Title</th>
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<tbody>
<tr>
<td>EB 410</td>
<td>Bio-Med. Elect System 392</td>
<td>2</td>
<td>3</td>
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<tr>
<td>EB 420</td>
<td>Instrumentation Project</td>
<td>2</td>
<td>6</td>
<td>2</td>
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<tr>
<td>EB 430</td>
<td>Codes-Laws-Safety</td>
<td>1</td>
<td>1</td>
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<tr>
<td>ED 420</td>
<td>Microprocessor Theory</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>MB 136</td>
<td>Applied Physiology</td>
<td>3</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>12</td>
<td>13</td>
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</tbody>
</table>
Computer-aided Design and Drafting

PROGRAM
Drafting Computer-aided Design

CONTACT
Don Watts
Program Head for Drafting Technologies
Boise State University
1910 University Drive
Boise, ID 83725
(208) 385-1538

ASSISTANCE AVAILABLE
None

SYLLABUS AVAILABLE
In press

START DATE
1984

COMPETENCY BASED
Yes

PROGRAM DESCRIPTION
Auto-CAD and Auto-Trol automated drafting systems are utilized in mechanical, architectural, and civil and electronic drafting. Thirty to forty percent of assignments utilize computer-aided design in a four-semester sequence. Associate of applied science and bachelor of applied science degrees are available.
Computer-aided Design and Drafting

**PROGRAM**
Drafting and Design Technology with Computer-aided Design

**CONTACT**
Paul L. Quay
Dean of Applied Sciences
Delaware County Community College
Media, PA 19063
(215) 359-5288

**ASSISTANCE AVAILABLE**
Yes

**SYLLABUS AVAILABLE**
Yes

**START DATE**
1981

**COMPETENCY BASED**
Yes

**PROGRAM DESCRIPTION**
The Drafting and Design Technology with Computer-aided Design Program prepares students for employment as entry-level drafters and provides the technical background required for advancement as drafters and designers. In 1981-82, the use of computer-aided design was added to the program competencies using the CADWEL system and Computervision equipment. Early in 1984, Delaware County Community College was selected to participate in IBM's program of support for technical curricula and received a donation of the IBM Fastdraft system. This program is articulated with the local secondary vocational school drafting and design program.

*Technical assistance available:
- Additional information about the program
- Consultants for proposal preparation, curriculum development, program review, and equipment selection*
The Drafting and Design Technology Program serves students in the disciplines of machine structural drafting and design and electromechanical drafting. In this 2-year program, design and drafting skills are emphasized by requiring the student to spend 18-20 hours per week at the drawing board. Mathematics through trigonometry is also taught along with courses in communications, statistics, and strength of materials. Instruction will be given on the computer-aided design system (HP1000 Holguin software). A portion of the drawings assigned will be done on the computer-aided design system. It should be emphasized that a computer-aided design system is a tool. Strong design and drafting skills continue to be the focus of the program.

Technical assistance available:
- Upgrading courses available to the community
- Information about various systems

*A revised program outline will be available soon. Computer-aided design will not be taught as a separate course in this program but as an integral part of design-drafting lab.
**PROGRAM**

Computer-aided Design

**CONTACT**

Dallas Garrett  
Division Chairman of Engineering and Computer Technology  
Lorain County Community College  
1005 N Avbe Road  
Elyria, OH 44035  
(216) 365-4191, ext 435

**ASSISTANCE AVAILABLE**  
Yes*

**SYLLABUS AVAILABLE**  
Yes

**START DATE**  
1983

**COMPETENCY BASED**  
Yes

**PROGRAM DESCRIPTION**

The computer-aided design option of the associate degree was made available in 1983. The associate of applied science degree has been offered since the early 1960s. A Computervision CADDS IV system was selected to implement the program, along with 22 IBM computers.

Over 200 students are enrolled in the Computer-aided Design Program. It is in operation 24 hours per day. Success in placing students in employment is exceptional.

*Technical assistance available:

- Basic program philosophy statement
- Program brochures
- Curriculum guides
- Course descriptions
- Course outlines
- Instructional materials (manuals)
- Scheduling techniques
- Placement information
- Job Training Partnership Act program writing assistance
- Industrial contacts
- Use of laboratory assistants
The goals of the Mechanical Drafting and Design Technology Program are as follows:

- Prepare students in the graphic art of communication including detail and layout drafting, tool and die design, structural drafting, product illustration, electrical drafting, and production.
- Prepare students in the theory aspects of all related subjects including mathematics, stress emphasis, metallurgy, production, and machine design for job entry-level employment.
- Develop students' abilities in human relations, communications, and other aspects of general education.

Mechanical drafters assist in designing and perfecting machines, processes, materials, and services in the complex world of work. Mechanical drafting jobs frequently require the ability to apply scientific principles or to solve, design, process, or service problems.

Technical assistance available:

- Visits to the college mechanical drafting and design department upon request
- Sample lesson plans
- College catalogs
This program of study is designed to teach drafting technicians to prepare the technical documents that are required for developing design ideas. Technical drafting and design technicians may select careers in one or more areas such as drafting with an emphasis on design in fields such as machine, mapping, architecture, process piping, structural, or the electrical and electronics industry.

An introduction to computer-aided design drafting and computer-aided manufacturing is a part of this program. Topics include such areas as system configuration, operation, and utilization. Skills in the use of computer-aided design and computer-aided manufacturing in selected specialty areas are developed. Two- and three-dimensional graphic representations are included in the students' repertoire of skills.
Computer-aided Design and Drafting

PROGRAM

Industrial Drafting and Design Technology

CONTACT

Russell L. Kline, Department Head
William Nelson, Assistant Director of Instruction
Oklahoma State University Technical Institute
900 N. Portland
Oklahoma City, OK 73107
(405) 947-4421

ASSISTANCE AVAILABLE

Yes

SYLLABUS AVAILABLE

Yes

START DATE

1962

COMPETENCY BASED

No

PROGRAM DESCRIPTION

The Industrial Drafting and Design Technology Program is designed to provide students with an understanding of engineering principles utilized in high-tech applications and drafting skills (encompassing computer-aided design experience) and applicable to practical problems in design and graphic illustration. The program leads to an associate of science degree in engineering technology. Students are prepared for employment in a variety of fields of manufacturing and engineering technology. An engineering technician fills a gap in the engineering process by linking design and production control in manufacturing. This individual aids in the refinement of existing designs, the development of new ideas, the preparation of design layouts and working drawings, and the supervision of manufacturing processes.

*Technical assistance available:

- Printed materials, when available, mailed upon request
- Tours of the institute's facilities
- Consultants on a fee or cost-recovery basis (including travel, lodging, and meals)
## Computer-aided Design and Drafting

<table>
<thead>
<tr>
<th>Program</th>
<th>Drafting Design Technology (Computer-aided Design Technology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Clifford D. Layton</td>
</tr>
<tr>
<td></td>
<td>Computer Science Division Director</td>
</tr>
<tr>
<td></td>
<td>Rogers State College, College Hill</td>
</tr>
<tr>
<td></td>
<td>Claremore, OK 74017</td>
</tr>
<tr>
<td></td>
<td>(918) 341-7510, ext 286</td>
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<table>
<thead>
<tr>
<th>Assistance Available</th>
<th>Yes*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syllabus Available</td>
<td>Yes</td>
</tr>
<tr>
<td>Start Date</td>
<td>1983</td>
</tr>
<tr>
<td>Competency Based</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Program Description

The Rogers State College Computer-aided Design Technology Program comprises a 2-year computer-aided design degree program, computerized drafting for drafting and engineering students, computerized graphic arts for art students, and varied elective course possibilities for computer science students and others.

Microcomputer and minicomputer computer-aided design hardware and software and educational expertise are shared among the computer-aided design, computer science, drafting, engineering, art, and other programs on the Rogers State Campus.

*Technical assistance available:

- Information concerning computer-aided design software, hardware, curriculum, feasibility, instructor recruitment, classrooms, and labs.
# Computer-aided Design and Drafting

## Program

| Drafting and Design Technology |

## Contact

Bill F Brown  
Coordinator  
Technical-Occupational Education  
Rose State College  
6420 S.E. 15th  
Midwest City, OK  
(405) 733-7395

## Assistance Available

| Yes* |

## Syllabus Available

| Yes |

## Start Date

| 1970 |

## Competency Based

| Yes |

## Program Description

The associate in engineering technology degree, offered as part of this program, is designed to prepare students, through an integrated theoretical and practical approach, to obtain employment in the industrial drafting and design technology fields. Program credits are transferable to universities where technology is offered. Students must complete courses with a minimum grade of C in each to receive the associate in engineering technology degree.

The industrial drafting and design technology certificate, which can be earned in this program, allows students to get a major portion of the program requirements in the associate degree in industrial drafting and design technology without taking the general education courses. Certificate recipients have the fundamental knowledge and skills required of industrial drafting and design personnel in a wide variety of industrial areas.

*Technical assistance available:

- Information on computer-assisted drafting principles and practices at Rose State College
PROGRAM
Drafting and Printed Circuit Design

CONTACT
Lee Teitel
Director, CAD Program
Roxbury Community College
625 Huntington Avenue
Boston, MA 02115
(617) 734-1960

ASSISTANCE AVAILABLE
Yes
SYLLABUS AVAILABLE
No

START DATE
1983
COMPETENCY BASED
Yes

PROGRAM DESCRIPTION
Students receive traditional (on the board) electromechanical drafting skills in the first year as well as an introduction to CAD. The second year reverses this, with most of the coursework on CAD and only an advanced manual Printed Circuit Design course required on the boards. Students also take courses in electronics, computer logic, programming, English, math, humanities, and social science.
Computer-aided Design and Drafting

**PROGRAM**

Computer-aided Design

**CONTACT**

Peto Fricano  
Instructor  
Triton College  
2000 5th Avenue  
River Grove, IL 60171  
(312) 456-0300

**ASSISTANCE AVAILABLE**

Yes*

**SYLLABUS AVAILABLE**

Yes

**START DATE**

1980

**COMPETENCY BASED**

Yes

**PROGRAM DESCRIPTION**

Computer-aided design is a major option of the 2-year associate of applied science engineering design-drafting and technology degree and the 1-year certificate. In addition, a four-course advanced certificate is available to former graduates or individuals from industry who have on-the-job experience necessary for the computer-aided design courses. A wide range of hands-on experience is available through increasingly sophisticated equipment, including Techtronics, Bausch and Lomb (Winchester system), and Computervision. A renovated laboratory was installed in 1984.

*Technical assistance available:

- Campus visits and sharing of ideas and information through correspondence and telephone calls.
Computer-aided Design and Drafting

PROGRAM
Drafting and Design Technology

CONTACT
Sam Redding
Chairman
Science and Engineering Technologies Division
Tulsa Junior College—Northwest Campus
3727 E Apache
Tulsa, OK 74115
(918) 834-5071

ASSISTANCE AVAILABLE
None

SYLLABUS AVAILABLE
Yes

START DATE
1970

COMPETENCY BASED
No

PROGRAM DESCRIPTION
This program prepares the student for a career as a professional drafter. Employment opportunities for those completing the associate degree program include positions such as drafter, checker, layout technician, specification writer, design technician, and laboratory technician.

In addition to general education requirements, the following specialized courses and controlled electives are required:

Engineering
10 Hours
EGR 1063  Descriptive Geometry
EGR 1313  Manufacturing Processes
EGR 2314  Statics and Strength of Materials

Drafting & Design Technology
18 Hours
DRF 1323  Basic Drafting
DRF 1333  Intermediate Drafting
DRF 2313  Advanced Drafting
DRF 2333  Special Design
DRF 2363  Electronic Drafting (or)
ELE 1303  DC Electronics
DRF 2373  Computer Graphics
### Controlled Electives

<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>BUS 1313</td>
<td>Employee-Employer Relations</td>
</tr>
<tr>
<td>BUS 2363</td>
<td>Supervisory Management</td>
</tr>
<tr>
<td>CSC 1202</td>
<td>Computer Concepts AND</td>
</tr>
<tr>
<td>CSC 1221</td>
<td>Introduction to FORTRAN OR</td>
</tr>
<tr>
<td>CSC 1231</td>
<td>Introduction to Assembly Language</td>
</tr>
<tr>
<td>DRF 1353</td>
<td>Architectural Drafting</td>
</tr>
<tr>
<td>DRF 1363</td>
<td>Civil Drafting</td>
</tr>
<tr>
<td>DRF 2323</td>
<td>Production Illustration</td>
</tr>
<tr>
<td>DRF 2343</td>
<td>Process Piping Drafting</td>
</tr>
<tr>
<td>DRF 2353</td>
<td>Structural Drafting</td>
</tr>
<tr>
<td>MAT 1326</td>
<td>Machine Shop Technology I</td>
</tr>
<tr>
<td>MAT 2333</td>
<td>Basic Numerical Control Programming</td>
</tr>
<tr>
<td>MAT 2353</td>
<td>Basic APT Programming</td>
</tr>
<tr>
<td>SUR 1323</td>
<td>Surveying Problems I</td>
</tr>
<tr>
<td>WEL 2413</td>
<td>Welded Pressure Vessel Design</td>
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12 Hours
Program Description

Drafting and design technicians prepare working drawings from layouts, sketches, or verbal instruction. They are highly skilled in lettering, both freehand and with lettering equipment, tracing work, engineering order changes, and special drawing changes and preparations. They design and lay out entire projects and validate the finished product in the fields of mechanical, electrical and electronic, structural, architectural, and civil drafting. In addition they are skilled in technical illustration and piping, welding, and plastics drafting. All of these require the utilization of computer-aided drafting systems. A Talon system is in use. Students participated in the development of the hardware and software for this system. The system uses high-resolution, high-speed, computer-aided drafting and design software for mechanical, architectural, structural, electrical, and civil drafting. In addition to classroom instruction, the program also provides experience with surveying techniques and has an active cooperative education program and placement program.

*Technical assistance available:

- Consulting services
Computer-aided Manufacturing

PROGRAM

Computer-aided Design and Computer-aided Manufacturing

CONTACT

S.G. Steele
Dean of T E C Division
Director CAD/CAM Center
Broome Community College
P.O. Box 1017
Binghamton, NY 13902
(607) 771-5014

ASSISTANCE AVAILABLE

Yes

SYLLABUS AVAILABLE

Yes

START DATE

1982

COMPETENCY BASED

Yes

PROGRAM DESCRIPTION

At Broome Community College, computer-aided design and computer-aided manufacturing are integrated into electrical engineering technology, civil engineering technology, mechanical engineering technology, engineering science, and computer science. Required courses are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CAD 200</td>
<td>Introduction to Computer Graphics</td>
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<tr>
<td>CAD 201</td>
<td>Advanced Computer Aided Graphics</td>
<td>3</td>
</tr>
<tr>
<td>CAD 220</td>
<td>Printed Circuits, Electrical Schematics, and Wiring Diagrams</td>
<td>3</td>
</tr>
<tr>
<td>CAD 230</td>
<td>CAD System Operations</td>
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<td>CAM 210</td>
<td>Computer-aided Numerical Control I</td>
<td>3</td>
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<tr>
<td>CAD 299</td>
<td>Independent Study</td>
<td>3</td>
</tr>
</tbody>
</table>

'Technical assistance available:
- Consultants for colleges implementing courses
- Assistance with short-term training for new personnel
- Tours and demonstrations upon request
Program Description

This 2-year program leading to the associate of applied science degree trains technicians to be computer-aided design drafters or computer-aided design and computer-aided manufacturing systems operators. A core of computer-aided design and computer-aided manufacturing courses is complemented by a series of technical courses taken in the student's choice of three areas of specialization.

- Mechanical design
- Electronics design
- Systems operation and analysis

Technical assistance available:

- Additional information about the program
Computer-aided manufacturing at Triton College is one of four options available through the Manufacturing Engineering Technician Program (robotics, industrial controls, quality control, computer-aided manufacturing). Students complete a common core of courses during the first semester designed to provide an appropriate background in technical math, physics, drafting, electronics, and machine-related areas and then move into their specialty during the second year. In addition to the associate of applied science degree program, a 1-year program and short-term advanced certificate are also available.

For those students wishing to have an extensive background in operation of machines, the Machine Tool Technology Program permits them to major in the second year in computer-aided manufacturing courses.

Technical assistance available:

- Sharing of ideas and information through correspondence and telephone calls
Computer Engineering Technology

PROGRAM

Computer Maintenance

CONTACT

Northern Essex Community College
100 Elliott Street
Haverhill, MA 01835
(617) 374-0721

ASSISTANCE AVAILABLE

Yes

SYLLABUS AVAILABLE

Yes

START DATE

1980

COMPETENCY BASED

No

PROGRAM DESCRIPTION

This career program trains students for positions as technicians skilled in digital computer software and hardware. Students concentrate on programming in assembly language and higher level languages and on analyzing and troubleshooting electronic circuits and systems. Laboratories emphasize hands-on experience with up-to-date computers and electronic instruments.
The Computer Technology Program offers two options—business programming and computer science—that train students in the skills necessary for employment in data processing. Students receive extensive experience writing, keying in, and "debugging" programs on the college's computer systems. Graduates have entered varied areas of computer technology, including systems analysis training programs, programming, and data processing management.
The Computer Maintenance Technology Program is designed to provide the students with the necessary electronics background and the computer know-how to deal with the ever-changing computer technology of the space age.

<table>
<thead>
<tr>
<th>Semester 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
</tr>
<tr>
<td>LE 100</td>
</tr>
<tr>
<td>EP 101</td>
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<td>ET 110</td>
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<td>ET 115</td>
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<td>MM 106</td>
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SEMESTER 3

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<td>LE 202</td>
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<td>ET 310</td>
<td>Active Networks 2</td>
<td>3</td>
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<td>3</td>
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<td>ET 340</td>
<td>Comp. Architecture and Logic Circuitry</td>
<td>3</td>
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<td>ED 330</td>
<td>Machine &amp; Assembly Language Programming</td>
<td>3</td>
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<td>ED 350</td>
<td>Dig. Electric. Lab 1</td>
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<td>4</td>
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<td>EP 320</td>
<td>Data Communications</td>
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SEMESTER 4

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<td>Microprocessor Theory</td>
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<td>ED 450</td>
<td>Adv Computer Topics</td>
<td>3</td>
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<td>ED 410</td>
<td>Adv Digital Elec Lab</td>
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<td>ET 430</td>
<td>Digital Comp Systems</td>
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<td>ET 440</td>
<td>Integrated Electronics</td>
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<td>MP 119</td>
<td>Technical Physics</td>
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</table>
The primary electronics curriculum at Westark Community College is a 2-year associate of applied science degree program. It is unusually comprehensive in modern computer and programming courses, as well as the more traditional subjects such as radio and TV. Equal emphasis is placed on theory and laboratory work. The school has exceptional laboratory facilities. Students must demonstrate hands-on skills on various pieces of equipment to pass the courses in addition to passing traditional examinations on circuit and system theory. Graduates of this program are experienced in troubleshooting industrial control circuits, single board computers, digital and analog circuits, and radio and television.

Program graduates may elect to enroll in an optional third year of concentrated training in microprocessor and computer technology. This program provides additional training in computer systems, robotics, interface techniques for industrial control, and related programming.

*Technical assistance available:
  - Technical advice on course content and conduct
  - Equipment, text, and software recommendations
  - Orientation seminars
Computer Engineering Technology

PROGRAM

Computer Engineering Technology

CONTACT
Joe Avampato
Department Head
York Technical College
U S. 21 Bypass
Rock Hill, SC 29730
(803) 324-3130

ASSISTANCE AVAILABLE
Yes*

SYLLABUS AVAILABLE
Yes

START DATE
1981

COMPETENCY BASED
No

PROGRAM DESCRIPTION

This program takes advantage of existing programs in order to operate on a restricted budget. It includes courses from both electronics and computer technologies. It is designed to train students in computer programming and digital electronics. The outcome is an engineering technician who is employable in computer service, sales, training, and programming.

*Technical assistance available:

- Additional information about the program
Computer Numerical Control

PROGRAM

Computerized Numerical Control Machining

CONTACT

Kim Morgan
Professor
Clark College
1800 E. McLoughlin Boulevard
Vancouver, WA 98663
(206) 699-0234

ASSISTANCE AVAILABLE

None

SYLLABUS AVAILABLE

Yes

START DATE

1978

COMPETENCY BASED

Yes

PROGRAM DESCRIPTION

Clark College does not offer a major in computerized numerical control machining. However, supplementary classes are offered. The full 2-year daytime program offers an associate degree requiring the following courses.

MACH 251 Basic Numerical Control—This course teaches writing and testing programs for the computer numerical control mill and involves 3 hours of lecture per week.

MACH 252 Advanced Numerical Control—This course includes programming the Cinnimate, Pratt-Whitney, Brown-Sharpe, Acroloc, and Burgmaster tape-controlled mills and drills and various address systems and knowing the safe and proper setup procedures. It involves 3 hours of lecture per week. MACH 251, with a grade of C or better, or the consent of the instructor is required to enroll in this course.

MACH 253 Advanced Numerical Control—This course involves programming the numerical control lathe, programming for various machine operations such as facing, turning, boring, and threading; and safe and proper setup procedures. It involves 3 hours of lecture per week. MACH 251, with a grade of C or better, or the consent of the instructor is required to enroll in this course.

MACH 254 Computer-assisted Programming—This course teaches how to use the Compact II time-sharing system to program the numerical control or computerized numerical control milling machine, knowledge of Compact II program language, and how to operate various terminals and the Hewlett-Packard plotter. It involves 5 hours of lecture per week.
This is a certificate program in advanced machining to teach students to operate computerized numerical control equipment. The course includes information related to feed and speed for different types of metals. Tape coding used in programming, consisting of RS-244A and RS-358, is taught. The study of machine controls, setting tools, and machine limits and capabilities is included.

In machine operations, the course covers the sequences of operation, alignment of the fixture, proper loading of the workpiece, how to verify the accuracy of tape, how to edit the program, machine control, setup of tools, and adjustment of the feed and speed at the machine.

*Technical assistance available:*

- Observation and training
<table>
<thead>
<tr>
<th>CONTACT</th>
<th></th>
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<tbody>
<tr>
<td>Charles Granger</td>
<td>Department Head</td>
</tr>
<tr>
<td>Greenville Technical College</td>
<td></td>
</tr>
<tr>
<td>P O Box 5616, Station B</td>
<td></td>
</tr>
<tr>
<td>Greenville, SC 29606</td>
<td></td>
</tr>
<tr>
<td>(803) 242-3170, ext 225</td>
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<table>
<thead>
<tr>
<th>PROGRAM DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>This is a group of nine courses that comprise a continuation of the Computerized Numerical Control Program. This program includes training on creating, editing, and debugging computerized numerical control programs. Students produce tapes with the aid of the computer and practice programming for machine centers and turning centers. Topics covered include the following:</td>
</tr>
<tr>
<td>- Circular and linear interpolation</td>
</tr>
<tr>
<td>- Tape format</td>
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<td>- Turret control</td>
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<tr>
<td>- Constant surface speed</td>
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<tr>
<td>- Proper operating of computer equipment</td>
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<td>- Safety</td>
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<th>SYLLABUS AVAILABLE</th>
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<td>ASSISTANCE AVAILABLE</td>
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<tr>
<td>COMPETENCY BASED</td>
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<tr>
<td>START DATE</td>
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</table>
### PROGRAM

Computer Numerical Control

### CONTACT

Dallas Garrett  
Division Chairman  
Engineering and Computer Technology  
Lorain County Community College  
2005 N Abbe Road  
Elyria, OH 44035  
(216) 365-4191, ext 435

### ASSISTANCE AVAILABLE

Yes

### SYLLABUS AVAILABLE

Yes

### START DATE

1983

### COMPETENCY BASED

Yes

### PROGRAM DESCRIPTION

The computerized numerical control option was made available in 1983. The associate of applied science degree has been offered since the early 1960s. A move into a new high-tech center will make it possible to integrate computer-aided design, computerized numerical control, and robotics in the computer-integrated manufacturing laboratory. The program is designed to teach innovative concepts and provide students with opportunities for field experiences. The following equipment is used:

- Vertical mills
- Turning centers
- P & W Mill Drill
- Vax 11/750 Computer with 24 peripherals, Apt IV, Compact II, N/C Graphics, Fortran, and Basic

*Technical assistance available:

- Program philosophy statement
- Course outlines and descriptions
- Textual materials
- Equipment purchase assistance
- Equipment donation assistance
- Software purchase assistance
- Placement information
- Industrial contacts
- Use of laboratory assistants
- Job Training Partnership Act program writing assistance
This 2-year (6 trimesters), 88 credit-hour program includes entry-level preparation on most conventional and numerically controlled machine tools. Machine-tool programming is done in the directly punched tape mode and computer-assisted mode using a variety of machine tool languages. The program prepares graduates for employment in a wide variety of machine tool positions, from machine operator to manufacturing technician, with an equally wide variety of organizations.

Technical assistance available:

- Suggestions on program organization
- Assistance with faculty training
- Recommendations on facilities development
- Information about equipment selection
### PROGRAM

**Numerical Control Service Technology**

### CONTACT

Bill J. Lyons  
Department Head for Electrical-Electronics  
Oklahoma State University  
School of Technical Training  
4th and Mission Road  
Okmulgee, OK 74447  
(918) 756-6211, ext 252

### ASSISTANCE AVAILABLE

Yes

### SYLLABUS AVAILABLE

No

### START DATE

1982

### COMPETENCY BASED

Yes

---

**PROGRAM DESCRIPTION**

An automated equipment technician is responsible for maintaining machine performance and will typically be involved in a coordinated effort with engineers, other technicians, and production operators. Career preparation in this field requires a solid background in electronics, mechanics, hydraulics, pneumatics, and thermal technology, as well as a knowledge of manufacturing materials, processes, and equipment.

The Numerical Control Service Technology Program is a multidiscipline effort involving classes in electrical-electronics, air-conditioning and refrigeration, diesel, drafting, and manufacturing departments.

Requiring 61 credit hours for completion, this program includes courses in electrical controls, basic programming and machining, fluid power, motors and controls, computer graphics, and numerical control computer systems.

Graduates of the Numerical Control Service Technology Program may elect to engage in additional course work in the area of industrial robotics. Upon satisfactory completion of this option, students earn an associate of technology in computer-integrated systems service degree.
The Electrical Technology Program prepares students for work in the development, installation, and maintenance of industrial automated systems. Graduates of the program have also been successful as field representatives for manufacturers in the areas of product application and sales. Students planning to enter this field should have a desire for achievement and involvement in mathematics, science, and technology.

Minimum Grade Requirements: All EE and ET series Electrical Technology courses must be successfully completed with a grade of D or better for graduation. These Electrical Technology courses must be taken in a sequential order. That is, second semester courses cannot be taken until the first semester prerequisite courses are successfully completed as outlined in the Electrical Technology program. Before starting the third semester, the student must have successfully completed the Mathematics Modules MM 105-109. Upon the successful completion of requirements for this program, as listed below, the degree of Associate in Science in Electrical Technology will be awarded.

SEMESTER 1

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<thead>
<tr>
<th>Number</th>
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<th>Class</th>
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<tr>
<td>LE 106</td>
<td>English Composition 1</td>
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<tr>
<td>EE 110</td>
<td>Fund. of Electricity 311</td>
<td>3</td>
<td>3</td>
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<tr>
<td>EE 120</td>
<td>Engt. Graphics 311</td>
<td>3</td>
<td>3</td>
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<tr>
<td>NP 109</td>
<td>Human Relations at Work</td>
<td>3</td>
<td>3</td>
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<tr>
<td>MM 101</td>
<td>Mathematics*</td>
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<tr>
<td>MM 102</td>
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<td>MM 231</td>
<td>Engineering Computations</td>
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### SEASON 2

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<td>Comp 2: Intro to Lit</td>
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<td>LE 203</td>
<td>Fundamentals of Speech</td>
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<td>EE 210</td>
<td>A.C Fundamentals</td>
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<td>MM 108</td>
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### SEASON 3

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<tr>
<td>EE 310</td>
<td>Elec. Cont. for Machines</td>
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<td>EE 320</td>
<td>Ind. Electron. Circuits 1</td>
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<td>EE 330</td>
<td>Semicond./Transistors 1</td>
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<td>ET 340</td>
<td>Computer Conc &amp; Logic Cir</td>
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<td>MP 119</td>
<td>Technical Physics</td>
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<td>LE 202</td>
<td>Technical Report Writing</td>
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<td>EE 410</td>
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<td>EE 430</td>
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<td>EE 440</td>
<td>Electro-Mech Crt. Design</td>
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<td>ED 420</td>
<td>Microprocessor Theory</td>
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<td>EE 450</td>
<td>Oper. Amplifier Circuits</td>
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</table>

**Math courses MM 104 through MM 109 must be completed and passed by the start of the third semester.**
This program includes a basic first-year electronics course. Three second-year options are available: electronic technology, electronic service technology, and semiconductor electronics. An associate of applied science and a bachelor of applied science degrees are available.
The Digital Electronics Option includes courses in electricity, electronics, semiconductor devices, logic circuits, digital theory, electronics fabrication, microprocessor theory, practical circuit analysis, and computer repair as well as English, mathematics, and liberal arts electives.

This intensive program combines classroom work with electronics laboratory experience. Using state-of-the-art equipment, students are able to duplicate the same connections, tests, and measurements that will be required by an employer. Skilled technicians will find that demand for their abilities is increasing in industry, telecommunications, and medical facilities where they are needed to assist in the design, testing, repair, and maintenance of electronic equipment.

To be eligible for admission to the Electronic Technology Program applicants must have completed through Algebra I and II with a grade of C or better.

**First Semester**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>ENG 102</td>
<td>College English II</td>
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<tr>
<td>MAT 191*</td>
<td>Technical Mathematics</td>
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<td>ETT 103*</td>
<td>Introduction to Electricity and Lab</td>
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<td>ETG 111</td>
<td>Computer Systems for Electronics Technology</td>
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<td>Behavioral/Social Sciences Elective</td>
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<td>ENG 103*</td>
<td>College English III</td>
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<tr>
<td>ETT 153*</td>
<td>Semiconductor Devices and Lab</td>
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<td>ETT 155*</td>
<td>Digital Theory and Lab</td>
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<td>ETG 151*</td>
<td>Programming for Electronics</td>
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Total Credits: 17

## Third Semester

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<thead>
<tr>
<th>Course</th>
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<tr>
<td>ETT 203*</td>
<td>Fundamentals of Electronics and Lab</td>
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<tr>
<td>ETT 205*</td>
<td>Logic Circuits</td>
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<tr>
<td>ETT 207*</td>
<td>Electronics Fabrication Techniques</td>
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<td>Liberal Arts Electives (2)</td>
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Total Credits: 16

## Fourth Semester

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tr>
<td>ETT 253*</td>
<td>Practical Circuit Analysis</td>
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<tr>
<td>ETT 255*</td>
<td>Microprocessor Theory and Lab</td>
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<tr>
<td>ETT 257*</td>
<td>Computer Repair</td>
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<td></td>
<td>Liberal Arts Elective</td>
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</table>

Total Credits: 15

Total Credits: 64

*Has prerequisite See Course Description
Program Description

The Optical Electronics Option includes courses in electricity, semiconductor devices, technical physics, electronics fabrication, optical theory, microwave theory, practical circuit analysis, fiber optics, and lasers as well as English, mathematics, and liberal arts electives.

This intensive program combines classroom work with electronics laboratory experience. Using state-of-the-art equipment, students are able to duplicate the same connections, tests, and measurements that will be required by an employer. Skilled technicians will find that demand for their abilities is increasing in industry, telecommunications, and medical facilities where they are needed to assist in the design, testing, repair, and maintenance of electronic equipment.

To be eligible for admission to the Electronic Technology Program applicants must have completed through Algebra I and II with a grade of C or better.

First Semester

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<tr>
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<tr>
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<td>MAT 191*</td>
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<td>ETT 103*</td>
<td>Introduction to Electricity and Lab</td>
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<td>Computer Systems for Electronics Technology</td>
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<td>Semiconductor Devices and Lab</td>
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<td>ETO 209*</td>
<td>Optical Electronics and Lab</td>
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<td>ETO 211*</td>
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<td>Practical Circuit Analysis</td>
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<td>ETO 255*</td>
<td>Fiber Optics and Lab</td>
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<td>ETO 257*</td>
<td>Lasers and Lab</td>
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## Total Credits

63

*Has prerequisite  See Course Description
Electronics Technology

**PROGRAM**

| Electronics Systems Technology |

**CONTACT**

| E. A. Dahlquist |
| Division Manager |
| Idaho State University |
| School of Vocational and Technical Education |
| Pocatello, ID 83209 |
| (208) 236-3851 |

**ASSISTANCE AVAILABLE**

| Yes* |

**SYLLABUS AVAILABLE**

| Yes |

**START DATE**

| 1941 |

**COMPETENCY BASED**

| Yes |

**PROGRAM DESCRIPTION**

The Electronics Systems Technology Program is designed to produce professional, highly skilled electronics technicians. Training includes audio, video, RF, digital, and pulse electronic systems. This program is, by design, a balance of analog and digital training. The program can be completed in 3 years.

Classes comprise 5 hours per week of mathematics, including algebra, trigonometry, analytic geometry, calculus, and Boolean algebra—all applied to the appropriate and concurrent theory and lab courses; 5 hours per week of theory; 2-4 hours per week of a related course such as report writing, physics, economics, drawing, or human relations, and 15 hours per week of laboratory work with state-of-the-art equipment and circuitry. This results in nearly equal time devoted to hands-on and theoretical aspects of electronics circuitry.

*Technical assistance available:

- Program outlines
The goals of the Electronics Technology Program are as follows:

- Provide students with entry-level skills in domestic, industrial, communications, and computer-oriented electronics
- Provide students with the technical competencies required to continue development in the field
- Develop students' abilities in human relations, communications, and other aspects of general education

Options available for the second year are as follows:

**The Communication Systems Technology**—This option is designed to qualify graduates for employment in the field of radio communications, including two-way radio, broadcast, and other electronic communication systems. Special emphasis is placed on solid-state equipment maintenance, including all types of radio communications gear.

**Computer Systems Technology**—This program is designed to provide graduates with the skills needed to obtain employment as technologists to operate computers and related automation equipment.

**Electronic Servicing Technology**—The goal of this program is to enable students to become skilled technicians with the ability to operate, install, and maintain all types of radio, television, and other electronic equipment.
Industrial Electronics Technology—This program is designed to qualify students for employment in the fields of industrial electronics and electronic maintenance, including the telephone industry. Technicians working with industrial electronics complete such tasks as preparing or interpreting layouts and other diagrams, developing and testing experimental electronic units, or performing maintenance and troubleshooting tasks. They assist scientists and engineers in designing electronic circuits. They also solve design problems, select suitable materials, and determine the best method of fabricating equipment.
The curriculum concentrates on developing complex, interdependent techniques for analyzing and designing electronic circuits. Heavy emphasis is put on the use of state-of-the-art devices and laboratory equipment, and the preparing of complete, analytical laboratory reports. There is a total of 68/69 credits required for graduation. The breakdown by major subject areas is as follows:

**Circuit Analysis** 8-12 Credits
**Electronics** 15-23 Credits
**Mathematics** 8 Credits (minimum)
**Physics** 8 Credits

**First Semester**

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<td>MA5621</td>
<td>Algebra &amp; Trigonometry</td>
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<td>ET6611</td>
<td>Circuit Analysis I</td>
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<td>CT6601</td>
<td>Fundamentals of Digital Logic</td>
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<td>CT6603</td>
<td>Digital Electronics Lab</td>
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**Total Credits:** 15
Electronics Technology

Second Semester

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<td>ET6612</td>
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Third Semester

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Fourth Semester

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<td>PI5622</td>
<td>Applied Physics II</td>
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Total Credits: 19

Third Semester Technical Electives: ET6662 Digital Electronics, CT6651 Assembly Language Programming, ET6653 Circuit Analysis III, MA565* Calculus for Technology, MA5691 Calculus I, CT6633 Intro to DP/BASIC

Fourth Semester Technical Electives: ET6690 Microcomputers, MA3652 Advanced Calculus for Technology, MA5692 Calculus II, CT6634 Advanced BASIC with Applications, CT6622 FORTRAN Programming, CT6682 Computer Applications in Engineering and Technology

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*Third Semester Technical Electives: ET6662 Digital Electronics, CT6651 Assembly Language Programming, ET6653 Circuit Analysis III, MA565* Calculus for Technology, MA5691 Calculus I, CT6633 Intro to DP/BASIC

**Fourth Semester Technical Electives: ET6690 Microcomputers, MA3652 Advanced Calculus for Technology, MA5692 Calculus II, CT6634 Advanced BASIC with Applications, CT6622 FORTRAN Programming, CT6682 Computer Applications in Engineering and Technology
The Electrical-Electronics Technology Program graduate is the key to the successful operation of such areas as computer technology, aerospace, communications, power generation, petrochemicals, and manufacturing. The graduate of a college-level program of study in electrical-electronics technology is skilled in research and development, field service, engineering support, and system design. The responsibilities and functions of these technicians are as diversified as the companies that employ them. The Electrical-Electronics Technology Program requires the completion of 90 credit hours. A minimum of 63 credit hours must be in technical classes and 27 credits must be earned in general education courses.

The technical curriculum consists of subjects in electrical fundamentals, electronic devices and circuits, electronic communication and controls, digital logic and design, microprocessors, and process control and instrumentation. Students receive 3,200 hours of theory classes and laboratory activities.
The Electronics Engineering Program is a 76-semester-hour program. It is mathematics and science based, and microcomputers and mathematics are emphasized through 2 courses (3 credit hours each) in technical calculus.

Technical assistance available:
- Curriculum development
- Course outlines
- Textbooks
- Laboratory equipment
This program prepares students to enter the labor market as electronics technicians. Most graduates work in electronic manufacturing where they are involved in testing and troubleshooting sophisticated electronic equipment. Some graduates become assistants to design engineers in the development of new electronics products.

Students entering this program must have skills equivalent to elementary algebra, basic writing, and basic reading for the technical industry.

Technical assistance available:

- Catalog and course outlines for the program
- List of suggested equipment
This electronics program is based upon the premise that the functions performed by electronic engineering technicians are closely related to research, development, and engineering activities. Accordingly, the electronics engineering technology curriculum is constructed so as to provide the educational background necessary for the many functions of technicians at the levels of design, development, production, and research. The program is structured so that it prepares graduates functionally to:

- enter into a job and be immediately productive with a minimum of on-the-job training,
- keep continually abreast of developments in technology; and
- advance into positions of increased responsibility.
## Electronics Technology

**PROGRAM**

Electronics Technology

**CONTACT**

Bill F Brown  
Coordinator  
Technical-Occupational Education  
Rose State College  
6420 S.E. 15th  
Midwest City, OK 73110  
(405) 733-7395

**ASSISTANCE AVAILABLE** | Yes  
**SYLLABUS AVAILABLE** | Yes  
**START DATE** | 1970  
**COMPETENCY BASED** | Yes

**PROGRAM DESCRIPTION**

The Electronics Technology Program—resulting in an associate in engineering technology degree—is designed to prepare students, through an integrated theoretical and practical approach, to accept employment in the electronics technology field. Program credits are also transferable to universities where engineering technology is offered.

- Computer specialist—electronic computers
- Electronic communications specialist—telecommunications
- Industrial electronics specialist—industrial electronics
- Optoelectronics specialist—optoelectronics
- Quality-control specialist—electronics industry
- Robotics specialist—robotics
- Mechanical specialist—electromechanical technology
- Electrical power specialist—electromechanical technology

The Engineering Mechanics Technology Program—resulting in an associate in engineering technology—is designed to prepare the student, through an integrated theoretical and practical approach, to accept employment in the engineering mechanics field. Program credits are also transferable to universities where engineering technology is offered.
The Electronics Technology Program is organized to present learning activities that will qualify the graduates to perform job functions in areas such as communications, control systems, computers, circuit design, and systems testing. Training for a wide variety of jobs is provided by a 2-year technical program of specialized, intensive instruction designed to fit individuals for useful employment as highly skilled technicians in the electronics field.

Minimum grade requirement: Students in Electronics Technology must receive a grade of D or better. A quarterly point average (QPA) of 2.0 must be achieved for graduation. Upon the successful completion of the requirements for this program, as listed below, the degree of associate in science in electronic technology will be awarded.

### SEMESTER 1

<table>
<thead>
<tr>
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<td>ET 115</td>
<td>Electronics Lab 1</td>
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<td>ET 110</td>
<td>Basic Electronics 1</td>
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<td>ET 120</td>
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<td>MM 101-103</td>
<td>Mathematics*</td>
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<td>NP 109</td>
<td>Human Relations at Work</td>
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**Total:** 13 credits
### SEMESTER 2

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<td>ET 210</td>
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<td>ET 215</td>
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<td>ET 220</td>
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<td>ET 310</td>
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<td>ET 320</td>
<td>Comm Systems 1</td>
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<td>ET 330</td>
<td>Fund of Pulse &amp; Dig Cir</td>
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<td>ET 340</td>
<td>Comp Archt. &amp; Logic Cir</td>
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<td>ET 350</td>
<td>Electronics Lab 3</td>
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### SEMESTER 4

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<td>EE 430</td>
<td>Semicond /Transistors 2</td>
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<td>EE 440</td>
<td>Electro-Mech Crt Design</td>
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<td>ED 420</td>
<td>Microprocessor i’theory</td>
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<td>EE 450</td>
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**Math courses MM 104 through MM 109 must be completed and passed by the start of the third semester.**
Electronics Technology

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>Electronics Technology</th>
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| CONTACT | Sam Redding  
Chairman  
Science and Engineering Technology Division  
Tulsa Junior College—Northeast Campus  
3727 E. Apache  
Tulsa, OK 74115  
(918) 834-5071 |
|---------|------------------------|

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<th>COMPETENCY BASED</th>
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This program prepares the student with the necessary knowledge and skills to gain employment as an engineering technician, field service technician, or production technician in the field of electronics and to be able to advance to positions of increasing responsibility. Upon completion of the program, the graduate may apply for the examination to become a Certified Engineering Technician given by the Institute of Engineering Technicians.

Section A: General Education Requirements; Credit Hours: 22

<table>
<thead>
<tr>
<th>English</th>
<th>6 hours</th>
<th>ENG 1113</th>
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<td>ENG 2333</td>
<td>Technical Writing or</td>
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*Course has prerequisite*
Electronics Technology

Section B: Specialized Course Requirements; Credit Hours: 36

Electronics

*ELE 1303  DC Circuit Analysis
*ELE 1313  AC Circuit Analysis
*ELE 1333  Instruments and Measurements
*ELE 2303  Systems Troubleshooting
*ELE 2313  Digital Electronics
*ELE 2333  Pulse Circuits
*ELE 2343  Electronic Communications
*ELE 2363  Electronic Amplifiers I
*ELE 2373  Electronic Amplifiers II
*ELE 2393  Digital Systems
*ELE 2443  Microprocessors
*ELE 2453  Advanced Microprocessors

Section C: Controlled Electives; Credit Hours: 6

BUS 1313  Employee-Employer Relations
CSC 1202  Computer Concepts and
CSC 1221  Intro to FORTRAN or
CSC 1231  Intro to Assembler Language
*DRF 1323  Basic Drafting
*EMR 1343  Electric Machines
*EMR 1353  Kinematics
*EMR 2303  Motor Control
*EMR 2323  Servo-Systems
*EMR 2393  Fluid Power

The 36 credit hours of specialized courses in section B contain those courses required for the Certificate of Achievement Program for electronics technology.
The Electronics Technology Technician Program is a 6-quarter program that leads to an associate of applied science degree or associate of science degree. If a student has not had basic AC and DC theory with accompanying mathematics, 2 additional quarters are required. The program provides students with the following:

- Basic knowledge of the atomic, chemical, and physical nature of energy in its various forms and its conversion in the production of direct and alternating current; voltage and electrical power; and the relationship of magnetic and electrostatic fields, resistance, reactance, impedance, electromechanical components, and radio frequency radiation in the conversion process.
- The ability to work with resistors, capacitors, inductors, transformers, semiconductors, tubes, relays, switches, hardware, and other electromechanical components of electrical and electronic circuits and equipment.
- The ability to fabricate, conforming to industrial standards, electronic and electromechanical equipment, printed circuit boards, and equipment containers, using basic hand tools, circuits, and ordinary shop equipment.
- An understanding of the theory and use of rectifiers, filters, amplifiers, oscillators, modulators, detectors, wave-shaping circuits, stepping motors, synchros, control transformers, servos, magnetic amplifiers, and other circuits that, when properly combined, make up electronic and electromechanical equipment.
- An understanding of the theory and use of receivers, transmitters, display devices, microprocessors, computers, and other equipment that, when properly combined, make up complete electronic and electromechanical systems.
• The ability to use ammeters, volt meters, and ohmmeters, resistance, capacitance, inductance, impedance, and other measurement bridges, audio and radio frequency generators, transistor and tube testers, oscilloscopes and oscillographs, and other commonly available electronic and electromechanical test equipment and test systems

• The ability to coordinate efforts with other members of a testing, production, or research team

• Sufficient communication skills to receive and transmit instructions, processes, and ideas, and understand policies concerning work and its relationship to others

• An understanding of the economics, organizational structure, various levels of work, and related factors within the electronics industry, all of which contribute to development of an effective and cooperative employer
This program prepares graduates for jobs as industrial electronic technicians in manufacturing, production, and service industries. The curriculum covers the fundamental systems information needed for work in the computer, communications, aerospace, and industrial instrumentation fields. Emphasis is placed on digital solid-state logic, semiconductor circuit theory and analysis, and microprocessors. Students learn computer languages, applications, and design. The electronics practicum provides students with practical application, analysis, and troubleshooting experience on electronic systems. Classroom lecture is supplemented by laboratory work with up-to-date equipment.

Technical assistance available:
- Curriculum design assistance
- Technical information
Program: Electromechanical Engineering and Mechanical Engineering (Robotics Option)

Contact:
Bristol Community College
777 Elsbree Street
Fall River, MA 02720
(617) 678-2811

Assistance Available: Yes
Syllabus Available: Yes

Start Date: 1968
Competency Based: Yes

Program Description:
Curriculum for these programs includes a 2-semester course in robotics and a 1-semester course in hydraulics and pneumatics. Students receive instruction in hydraulic and pneumatic applications on the state-of-the-art robotic equipment. They are trained in the theoretical, operational, and control concepts of robots, including programming, maintenance, installation, diagnostics, and supervision of robotic installations.

The carefully structured course sequences are built around applications, programming, process interface, and maintenance of robotics systems. Graduates will possess sufficient background experiences in the design, operation, and maintenance of industrial robots to compete successfully in this growing job market.
The Electromechanical Technician Program is a 72-week course of study consisting of six 12-week blocks of time. The program operates on a year-round basis and allows new students to enter at the start of any of these blocks when openings are available.

The curriculum is designed to provide students with a basic electromechanical background. Laboratories are furnished with up-to-date instruments and instructional equipment necessary to gain the expertise and skills to use the tools and diagnostic equipment needed in technical jobs. Instructional emphasis is placed upon the understanding and troubleshooting of electromechanical systems. Upon successful completion of the program, students receive the associate of applied science degree.
This program offers training in electrical, electronic, and mechanical technology, providing students with the necessary skills to pursue career opportunities as electronic technicians, electrical technicians, production technicians, and draftspersons. The program includes in its curriculum microprocessors, microcomputers, telecommunications, robotics, computer-assisted design, and computerized numerical control.
The Automation Specialist Program is designed to prepare students, through integrated theoretical and practical approach, for employment in the electromechanical technology field. Credit from the program is also transferable to universities where bachelor of science in technology programs are offered. Course options in electrical power and mechanics are also available. Students must make a grade of C or better in all program requirements in order to receive an associate in engineering degree in electromechanical technology.

Technical assistance available:

- Information about automation specialist, electrical power specialist, and mechanical specialist programs.
Program

Electromechanical Technology

Contact

Rita S. Meyer
Dean of Instruction
West Virginia Northern Community College
College Square
Wheeling, WV 26003
(304) 233-5900, ext 213

ASSISTANCE AVAILABLE
Yes

SYLLABUS AVAILABLE
Yes

START DATE
1982

COMPELENCY BASED
Yes

Program Description

This program prepares graduates for jobs in industrial instrumentation in the steel, mining, aluminum, electrical generation, and other related manufacturing industries. The curriculum covers the fundamental principles necessary for analysis and troubleshooting of electronic, hydraulic, and pneumatic systems. Emphasis is placed on digital solid-state logic, semiconductor circuit theory and analysis, and microprocessors. Students will examine and analyze hydraulic systems integrated with their ancillary controls in both electronics and pneumatics. Classroom lecture is supplemented by laboratory work with modern equipment.

Technical assistance available:

- Curriculum design assistance
- Technical information
### Program Description

The new automated manufacturing engineering technology curriculum involves a 2-year program featuring computer-aided design and computer-aided manufacturing, robotics, programming, application, advanced machine II.

Greenville Technical College is a beta test site for manufacturing software by InFiSy Systems, Inc., which gives students the chance to use the latest in software.

The computer-aided design and computer-aided manufacturing program includes the following equipment and facilities:

- Computervision 200X Computer
- CADDS 4X Software
- Cincinnati Milacron T10 and Cinturn
- Bridgeport Series II Vertical Mill
- Tree Turning Center (Lathe)
- Numeridex Computer-assisted Programming Robotics Lab
- Minicomputer Lab
- Microcomputer Lab
- Instrumentation Lab

### Technical Assistance Available:

- Seminars and Workshops
- Resource Center for identification of trends and innovations in high technology
- Guest Lecturers
Graphics Technology

**PROGRAM**

Computer Graphics Program

**CONTACT**

Victor G. Langer  
Manager of Computer-Based instruction  
Milwaukee Area Technical College  
1015 North Sixth Street  
Milwaukee, Wisconsin 53203  
(414) 278-6247

**ASSISTANCE AVAILABLE**

Yes

**SYLLABUS AVAILABLE**

Yes

**START DATE**

1980

**COMPETENCY BASED**

Yes

**PROGRAM DESCRIPTION**

Emphasis in the Milwaukee Area Technical College (MATC) Programs has been, first, to develop basic engineering skills and, second, to provide computer skills that can solve typical engineering and design problems. Learning how to use computer-aided design as a tool speeds up production. The challenge is to determine how to use computer-aided design as a tool and how computer graphics skills can be integrated into an existing curriculum. Objectives for each course must be analyzed.

In the Mechanical Design Technician Program, computer graphics objectives are integrated into six courses. In addition, two computer graphics courses are offered—an introductory course, that provides computer graphics operational skills and an advanced course designed to assist students in acquiring the skills necessary to apply computer-aided design to mechanical design problems, including three dimensional and descriptive geometry. The basic introductory computer-aided design course is also open to students in electrical technology, civil engineering technology, numerical control, commercial art, printing and publishing, and architectural technology programs.

An advanced course in electrical design includes printed circuit boards, electrical schematics, and other related applications. A new Electrical Design Technology Program now being developed emphasizes, first, the basics of mechanical design, electrical theory, and electrical drafting and then add computer graphic skills and electrical CAD. The Civil Engineering, Architectural Technology, and Commercial Art Departments are developing advanced application courses that are primarily offered as continuing education opportunities or as assignments for regular full-time students.
Continuing education courses offer an opportunity to test new areas with an industrial group, obtain direction for associate degree programs, and establish a relationship with a community of users. In a departure from engineering applications, computer graphics is being integrated into the telecasting program at MATC's channels 10 and 36. MATC's training opportunities in computer graphics are also being developed in production-related occupations where design databases become accessible for production purposes. The Welding Technology Department is developing instructions for obtaining the maximum number of parts cut out of a metal plate, automated flame cutting, and robotic welding. The Numerical Control Department developed a CAD to CAM interface going from design to actual cutting operations on numerically controlled machine tools. The Electrical Technology Department teaches industrial controls and other automation devices in a move toward computer-integrated manufacturing. The Electromechanical Technology Program is emerging as the basic program for preparing robotic service technicians. The Industrial Engineering Program brings together all CAD/CAM activities for efficient management of manufacturing and industrial processes.

MATC-CAD (TM) was developed at MATC to reduce the cost of design stations permitting use of the Computervision and Cadlinc systems for advanced courses. MATC-CAD is designed to be used primarily as an educational tool for teaching the basic elements of computer-aided drafting in the introductory course. The software is based on an emulation of most of the general two-dimensional capabilities of Computervision's CADDS-3 (TM) graphics system and uses the same student training manual. Hardware includes standard Apple II Plus or IIE microcomputer, graphics tablet, two floppy discs, and a green phosphor monitor with no modifications.

*Technical assistance available:

- "How to Start Up CAD Training" (brochure)
- "Software and Materials for Interactive Computer Graphics course to Run on an Apple" (brochure)
- Software and materials for computerized machining to run on an Apple (available soon)
PROGRAM
Industrial Optics

CONTACT
Richard King
Instructor
Industrial Optics
Pikes Peak Community College
5675 S. Academy Boulevard
Colorado Springs, CO 80906-5498
(303) 576-7711, ext 202

ASSISTANCE AVAILABLE
Yes*

SYLLABUS AVAILABLE
Yes

START DATE
1980

COMPETENCY BASED
Yes

PROGRAM DESCRIPTION
This program prepares students to work in the industrial optics industry. Graduates of this program may work in such areas as optics production, testing, or evaluation of optical components and systems. Students may receive a certificate or an associate of applied science degree in this program.

*Technical assistance available:
- List of equipment required for the program
- Catalog
- Condensed course outlines
<table>
<thead>
<tr>
<th>Laser Technology</th>
</tr>
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<tbody>
<tr>
<td><strong>PROGRAM</strong></td>
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<tr>
<td>Laser and Electro-Optics Technology</td>
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<table>
<thead>
<tr>
<th><strong>CONTACT</strong></th>
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<tbody>
<tr>
<td>Charles Chrestman</td>
</tr>
<tr>
<td>Assistant Director, Program Operations</td>
</tr>
<tr>
<td>Itawamba Junior College</td>
</tr>
<tr>
<td>653 Eason Boulevard</td>
</tr>
<tr>
<td>Tupelo, MS 38801</td>
</tr>
<tr>
<td>(601) 842-5621</td>
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<th><strong>COMPETENCY BASED</strong></th>
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<table>
<thead>
<tr>
<th><strong>PROGRAM DESCRIPTION</strong></th>
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<tbody>
<tr>
<td>The Laser and Electro-Optics Technology Program is a 2-year, associate of applied science degree program. The curriculum is interdisciplinary, with a collection of support, core, and specialty courses. Emphasis is placed on training technicians to operate, test, diagnose, and maintain lasers and other optical devices. Areas receiving the most emphasis are materials processing, communication, medical equipment, surveying, and construction.</td>
</tr>
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</table>
**Program Description**

The Mechanical Engineering Technology Program began in 1949 as a 2-year associate degree program entitled Engineering Technology and remained so until about 1963. At that time, two new engineering technology programs were implemented: one in civil engineering and one in electronics engineering. As a result, the department changed the program title Engineering Technology to Drafting and Design Technology (with a mechanical and an architectural option). In 1971, this title was changed to Mechanical Engineering Technology. The civil and electronics programs were accredited by ECPD in 1971 and the mechanical program was accredited in 1972. All three programs were re-accredited in 1981.

In 1984, IBM donated two complete Fastdraft systems for computer-aided design and a cash grant to be used to implement a new associate degree program manufacturing engineering technology with an emphasis on computer-aided drafting, automated systems, robotics, or computerized numerical control machining.

Technical assistance available:
- Consultants
- Course outlines
- Curriculum guides
Process Control and Instrumentation Technology

PROGRAM
Process Control and Instrumentation Technology

CONTACT
Melvin Smith
Director
CAD/CAM Center
Greenville Technical College
P.O. Box 5616, Station B
Greenville, SC 29606-5616
(803) 242-3170

ASSISTANCE AVAILABLE
Yes

SYLLABUS AVAILABLE
Yes

START DATE
1984

COMPETENCY BASED
Yes

PROGRAM DESCRIPTION
The program covers all the basics and advanced courses in electronic and pneumatic instrumentation and it can lead to a 2-year degree in process control and instrumentation. Upgrading and continued education courses are also available. Complete computer-interface-distributed control is taught.

Technical assistance available:
- Seminars and workshops
- Special short courses
- Resource center
- Guest lecturers
The Instrumentation Technology Program is designed to prepare students for employment as highly skilled technicians in the broad field of instrumentation.

Instrumentation refers to instruments for sensing changes in heat or pressure, for recording information, or for controlling manufacturing processes that are vital in research, business, space technology, and many areas of industry. Because the instrumentation is so important, there is great demand for people trained to install, calibrate, and maintain the equipment.

Graduates of this 2-year program leading to an associate in science degree may be employed as instrumentation technicians, engineering associates, instrumentation research or process technicians, or instrumentation field service technicians.

**SEMESTER 1**

<table>
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<td>LE 100</td>
<td>English Composition</td>
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<td>ET 110</td>
<td>Basic Electronics 1</td>
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<td>MM 101-103</td>
<td>Mathematics</td>
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<td>ET 115</td>
<td>Electronics Lab</td>
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## Process Control and Instrumentation Technology

**Continued**

### SEMESTER 2

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<td>Measuring Principles 2</td>
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<td>LE 200</td>
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<td>ET 210</td>
<td>Basic Electronics 2</td>
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<td>MM 105-</td>
<td>Mathematics</td>
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<td>ET 215</td>
<td>Electronics Lab 2</td>
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<tr>
<td>ET 220</td>
<td>Active Networks 1</td>
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<td>IT 120</td>
<td>Graphics for Instr Tech</td>
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<tr>
<td>IT 310</td>
<td>Control Principles 1</td>
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<td>EB 320</td>
<td>Calibration &amp; Standardiz</td>
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<td>MP 119</td>
<td>Technical Physics</td>
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<tr>
<td>ET 340</td>
<td>Com Architecture &amp; Log Cir</td>
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<td></td>
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<tr>
<td>IT 320</td>
<td>Hydraulics &amp; Pneumatics</td>
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### SEMESTER 4

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<tr>
<td>IT 410</td>
<td>Instr./Repair &amp; Trouble Shooting</td>
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<tr>
<td>FR 420</td>
<td>Instrument Project</td>
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<tr>
<td>NC 100</td>
<td>Economics 1 (or) Elective Soc Science</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>LE 202</td>
<td>Tech Report Writing</td>
<td>3</td>
<td></td>
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<tr>
<td>ED 420</td>
<td>Microprocessor Theory</td>
<td>3</td>
<td></td>
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<td>11</td>
<td>8</td>
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</table>
The automation and robotics curriculum is designed to prepare technicians to install, program, operate, maintain, service, and repair automated manufacturing systems, including robots. The course of study includes fundamentals of mechanical, electrical, and electronic technology with specific application of robots, controlling devices, and electromechanical equipment in automated manufacturing systems. The graduates of this curriculum will be prepared for employment in industries that utilize robots and other electromechanical devices in automated manufacturing.
Robotics Option

**Program Description:**
The robotics option provides knowledge and skills needed to install, operate, and maintain automated control systems. In the first year, students acquire a strong foundation in electronics. Courses include DC circuits and instruments, AC circuits, electronic devices and electronic circuits, digital computer systems, and integrated circuits.

In the second year, students specialize in areas ranging from electromechanical systems to electronic control systems. The principles of pneumatics and hydraulics as they pertain to automated systems are taught. Training in state-of-the-art robotics applications is emphasized.

Students enrolled in the robotics option have access to the college's Center for Productivity and Innovation, where they receive hands-on training with industrial-size robots and automated control systems found in modern factories.

Students completing the robotics option may seek employment as robotics or instrumentation technicians.

---

**Contact:**
J Leon Jones, Assistant Dean
Division of Engineering Technologies
Mathematics/Physics
Chattanooga State Technical Community College
4501 Amnicola Highway
Chattanooga, TN 37406
(615) 697-4445

**Assistant Available:** None
**Syllabus Available:** Yes
**Start Date:** 1980
**Competency Based:** No
The Robotics Technology Program is a 2-year associate of applied science degree program. It is an interdisciplinary program in which students receive training in robotics, fluid power, electronics, electricity, and programming.

Emphasis is placed on the integration of robotics into factory control systems. Local equipment controls, automated equipment controls, and material control systems used in the application and integration process are covered.

The technicians are trained to operate, test, and, in some cases, repair robots and other automated equipment.
**Robotics**

**PROGRAM**

Robotics (Servicing)

**CONTACT**

Ray Walsh  
Dean of Vocational and Technical Education  
Jefferson College  
Hillsboro, MO 63050  
(314) 789-3951 or (314) 942-3000

**ASSISTANCE AVAILABLE**

Yes  

**SYLLABUS AVAILABLE**

Yes  

**START DATE**

1983  

**COMPETENCY BASED**

Yes  

**PROGRAM DESCRIPTION**

Graduates of the Industrial Robot Production Maintenance Program are expected to find employment as robotics technicians who work in manufacturing plants installing, troubleshooting, repairing, servicing, and maintaining robots and robotics systems. Technicians who are employed by robot manufacturers also assist in the design, manufacturing, and testing of robots.

Coursework includes resistive circuits, single time constant circuits, numerical trigonometry, exponents and radicals, fundamentals of semiconductors, technical physics, introduction to programmable controllers, hydraulics and pneumatics (I & II), semiconductor circuit analysis, introduction to digital circuits, introduction to electric motors, introduction to robotics, pulse circuits, introduction to microprocessors, sensors and transducers, servicing robot systems, humanities, technical English, social science, and physical education/health.
The Automation-Robotics Technology Program provides the student with a broad range of technical skills in the electronic, electrical, and mechanical areas as they relate to the automatic control of manufacturing or other complex systems. State-of-the-art coverage is included on such topics as microprocessors, transducers, sensing devices, programmable controllers, and hydraulic and pneumatic systems. These individual topics are unified in courses dealing with the application of robots and troubleshooting. These courses provide the student with an understanding of the interaction of such equipment as it controls complex systems and with hands-on experience in correcting malfunctions in such systems.

There are a broad range of businesses and industries that utilize automated systems in their operations. Consequently, the number of jobs and their titles are varied and offer good opportunities for the graduates of this program.

Graduates of this program might take jobs as—

- maintenance technicians responsible for the repair and maintenance of automated manufacturing systems,
- robotics service technicians responsible for maintenance and repair of robots, or
- installation technicians responsible for the installation and start-up of automated systems.
The Certificate Program in Robotics Technology is designed to provide practical experience in a long list of disciplines that have broad application to the modern industrial setting. The individual will learn, practice, and apply basic principles of industrial electronics, computers, automated equipment, sensors, servos, steppers, relays, controllers, artificial intelligence, and more. The individual will gain practical hands-on experience with the basic elements of robotics, including programming, electronically controlled movement and positioning, interfacing, and data acquisition.

This is a 30-week certificate program providing a total of 29 academic credits in concentrated courses that develop skills essential for an individual to become a robotics-servicing technician.

First Semester

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>MA5687</td>
<td>Contemporary Math for Electronics</td>
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<tr>
<td>ET6111</td>
<td>Introduction to Electric Circuits*</td>
<td>4</td>
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<tr>
<td>CT6601</td>
<td>Fundamentals of Digital Logic</td>
<td>3</td>
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<tr>
<td>ET6603</td>
<td>Digital Lab*</td>
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<td>EN4401</td>
<td>English Composition I</td>
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<td>CT6682</td>
<td>Computer Applications in Engineering Technology</td>
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<td>ET6690</td>
<td>Microcomputers</td>
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<td>ET641</td>
<td>Robotics I</td>
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<td>E642</td>
<td>Robotics II</td>
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Hands-on laboratory work as integral part of course
Program Description

The Digital Control Technology Program is a specialized 2-year training program leading to an associate of applied science degree in digital control technology. Students who successfully complete the program will be prepared for entry-level positions as builders, installers, and repair persons working with a variety of automated systems in which equipment and machines are controlled by microprocessors. Numerically controlled machines and industrial robots are but two of many examples of such equipment. Requirements for the associate of applied science degree are as follows.

Technical Specialty Courses

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<tr>
<td>INT 160</td>
<td>Fundamentals of Electronics</td>
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<tr>
<td>INT 161</td>
<td>Amplifiers and Oscillators</td>
<td>8</td>
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<tr>
<td>INT 163</td>
<td>Communication Systems</td>
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<tr>
<td>INT 263</td>
<td>Digital Systems</td>
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<tr>
<td>INT 265</td>
<td>Microprocessors</td>
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<td>INT 267</td>
<td>ServoControl Systems and Industrial Robots</td>
<td>10</td>
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<tr>
<td>INT 116-119</td>
<td>Programming for Electronic Technicians</td>
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### Allied Supporting Classes

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<td>Technical Math</td>
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<td>MAT 112</td>
<td>Technical Math</td>
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<td>MAT 113</td>
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<td>ENG 101</td>
<td>Composition</td>
<td>3</td>
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<td>ENG 102</td>
<td>Composition</td>
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<tr>
<td>ENG 108</td>
<td>Technical Report Writing</td>
<td>3</td>
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<tr>
<td></td>
<td>General Education Electives</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(one course must be in social science)</td>
<td>18</td>
</tr>
</tbody>
</table>

| Total Credits | 102 |

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Continued
This curriculum prepares graduates for employment as service technicians, engineering assistants, and manufacturing and industrial maintenance technicians. Students gain laboratory experiences in electronic fundamentals, communication techniques, digital systems, and microprocessors. An SAT math score of 450 is required in order to complete the program in 4 semesters.

*Technical assistance available:
- Course syllabi
- Tours of facilities
PROGRAM  
Integrated Circuit Fabrication Technology

CONTACT  
Mike Reis  
Division Director  
Technical Occupations  
Pikes Peak Community College  
5675 S Academy Boulevard  
Colorado Springs, CO 80906-5498  
(303) 576-7711, ext 200

ASSISTANCE AVAILABLE  
Yes  
SYLLABUS AVAILABLE  
Yes  
START DATE  
1982  
COMPETENCY BASED  
Yes

PROGRAM DESCRIPTION  
The program is designed to prepare students for employment in the semiconductor integrated circuit manufacturing industry. Students in this program will have a strong background in chemistry and integrated circuit fabrication theory as well as hands-on laboratory experience to prepare them to become manufacturing process technicians in a highly technical and complex industry. Students entering this program must have skills equivalent to elementary algebra II, reading and study skills, and a review of writing skills.
Semiconductor Technology

**PROGRAM**

Semiconductor Technology Technician

**CONTACT**

Ralph Merrill  
Department Chairperson and Director  
Utah Technical College at Provo-Orem  
P.O. Box 1609  
Provo, UT 84601  
(801) 226-5000, ext 364

**ASSISTANCE AVAILABLE**

None

**SYLLABUS AVAILABLE**

Yes

**START DATE**

1983

**COMPETENCY BASED**

Yes

**PROGRAM DESCRIPTION**

This program is still in a developmental stage. At present, the program leads to a 2-year certificate or associate of applied science degree in semiconductor technology. The first year of the program combines the fundamental subjects of electronics, physics, chemistry, mathematics, BASIC language programming, and interpersonal skills. The second year provides specialized instruction to the students in semiconductor technology subjects such as production operations, process theory, electromechanical systems, team skills, and on-the-job training through cooperative education with industry. At present, the instructional aspects of the program are provided by Utah Technical College at Provo and Utah Technical College at Salt Lake with National Semiconductor providing the cooperative education aspect.
The Solar Technology Program prepares graduates for employment in the solar energy and construction fields as entry-level technicians. The program includes solar hydronics, heat transfer, energy utilization, sizing, air systems, and installation skills. Experience in the Alternate Energy Laboratory is an integral part of this associate degree program.

*Technical assistance available:

- Information about the program
- Consultants for proposal preparation, curriculum development, program review, and equipment selection
Telecommunications

PROGRAM
Telecommunications

CONTACT
Ray Walsh
Dean Vocational-Technical Education
Jefferson College
P.O. Box 1000
Hillsboro, MO 63050
(314) 789-3951/942-3000

ASSISTANCE AVAILABLE
None

SYLLABUS AVAILABLE
No

START DATE
1983

COMPETENCY BASED
Yes

PROGRAM DESCRIPTION
Jefferson College will be one of the first educational institutions in the Nation to have a complete terminal facility. There are three major types of equipment composing this facility: an FDM Multiplexer, a microwave radio, and a 1000 port Danray Switch.

This program includes both electronic theory and actual hands-on experience in the college's modern telecommunications lab. The curriculum was developed in cooperation with MCI, a leading company in the telecommunications industry.
REFERENCES


Alfred, R. L., and Nash, N. S. "Faculty Retraining: A Strategy Response to Changing Resources and Technology." *Community College Review* 2, no. 2 (Fall 1983).


"High-Technology Firms Defined." *Urban Land* 42, no. 6 (June 1983).


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- Retraining and Upgrading Workers A Guide for Postsecondary Educators

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