

# Maryland High School Career and Technology Education Programs of Study

## CAREER AND TECHNOLOGY EDUCATION



EDUCATING TOMORROW'S WORKFORCE TODAY



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# Career and Technology Education (CTE): Educating Tomorrow's Workforce Today

Career Technology Education (CTE) provides high school and community college students an opportunity to pursue a sequential technical and academic program of study leading to advancement in a career field. High school CTE programs of study give students the opportunity to transition smoothly into further education or postsecondary education and to earn college credit and/or industry credentials in a career field of interest.

Maryland leads the nation in the redesign of CTE programs as called for in the federal Carl D. Perkins Career and Technical Education Improvement Act of 2006. The Maryland State Department of Education (MSDE) works closely with the Governors Workforce Investment Board (GWIB) to identify new programs in response to Maryland's workforce development needs and to ensure all CTE programs of study keep pace with industry expectations and prepare students for their next steps toward college and careers.

## Career Clusters: The New Career Technology Education (CTE)

MSDE in partnership with statewide industry advisory groups, identified ten (10) **Career Clusters** that represent core business functions across broad industry areas in Maryland. Business partners further identified **career pathways** based on the end-to-end business processes within career clusters. This representation of industry clusters and career pathways is provided in the MSDE publication *Maryland Career Clusters: Restructuring Learning for Student Achievement in a Technologically Advanced, Global Society*<sup>1</sup> and serves as a starting point for the identification of Maryland CTE programs of study.

Career Clusters allow students to explore a wide range of career options and to apply academic and technical skills in a career area. Career Pathways are like road maps of learning that help students plan for and pursue further education and careers.

Using the Career Clusters Framework to develop new CTE programs at the high school helps students gain a better understanding of the world of work and what is required to prepare for a career. Each Career Cluster includes at least two CTE program options for students to gain more advanced understanding and preparation for a career field. For example, the chart below depicts the wide range of career fields in the Arts, Media, and Communication industry in Maryland. Students may choose from three CTE programs or arts-based programs to further explore these careers.

### Maryland's CTE Career Clusters

- Arts, Media, and Communication
- Business Management and Finance
- Construction and Development
- Consumer Services, Hospitality, and Tourism
- Environmental, Agricultural, and Natural Resources Systems
- Health and Biosciences
- Human Resource Services
- Information Technology
- Manufacturing, Engineering, and Technology
- Transportation Technologies

### Industry Career Pathways

Multimedia Production

Internet Production

Film, Radio and Games

Printing

Visual Arts

Performing Arts

Museum and Art Galleries

### High School Programs of Study

Interactive Media Production

Communication and Broadcast Technology

Graphics and Printing Communication Technology

Art, Music and Drama courses and programs are offered through the high school art department. These are not CTE programs of study.

<sup>1</sup>For more information about Maryland's Career and Technology Education programs, go to [www.MarylandPublicSchools.org](http://www.MarylandPublicSchools.org). Click first on Divisions and then on Career and College Readiness.

**The people of Maryland are our greatest asset, and our continued economic strength depends upon our ability to invest in them and prepare our children today for the jobs of tomorrow.**

*- Governor Martin O'Malley*

## Maryland CTE Programs of Study

Maryland CTE programs of study are statewide model programs designed to prepare high school students for the 21st Century's global economy and its rapidly changing workforce needs. All CTE programs are aligned to established academic and technical skill standards to ensure student preparation for college and careers. These programs also include work-based learning opportunities (e.g., internships, clinical experiences, or industry-mentored projects) tied to the student's area of interest. Upon completion of a Maryland CTE program of study, students also have the option to earn college credits and/or industry-recognized credentials such as certifications and licenses.

The Maryland CTE programs of study outlined in this document serve as a resource for local school systems and their community college partners. The programs included in this document are MSDE-developed programs designed with state and national-level partners, are standardized across the state and include opportunities for state-wide professional development for teachers. For each Career Cluster, MSDE has identified several new Maryland CTE programs of study for development. Most of the programs listed have been completed and are offered throughout Maryland. However, several programs are currently under development. Please review the program descriptions for specific information regarding each Maryland CTE program of study.

The Maryland State Department of Education, in collaboration with business, higher education, and local school systems provides guidance and support for the ongoing development of rigorous and relevant CTE programs of study that prepare students for both college and careers. Local school systems are encouraged to adopt the Maryland CTE programs of study outlined in this publication and to partner with higher education in supporting student transition to postsecondary education and careers. The MSDE is also collaborating with school systems, business and higher education to develop and expand CTE programs in high-demand careers, such as those in the Science, Technology, Engineering and Mathematics (STEM) disciplines.

Given that CTE programs are closely aligned with regional economic and work-force development priorities, not all high schools have programs in all career clusters. Based on local needs and opportunities, each school system decides which clusters and corresponding CTE programs to offer. For more information about local CTE programs of study, please contact the local school system or go to [www.MarylandPublicSchools.org](http://www.MarylandPublicSchools.org) for a link to the school district's web site.

## Preparing Today for the Jobs of Tomorrow

CTE programs are designed to support students in making decisions about education and career options. While students generally enroll in a CTE program in 10th or 11th grade, career exploration begins far earlier. In middle school, students participate in career-awareness activities—for example, field trips, job-shadowing, interest inventories—and develop high school plans, mapping out academic coursework and career options.

Today, high school students face many options for academic growth and career exploration. Making informed choices about their high school program of study will prepare them for success in further education and lead to a rewarding career. Students may learn more about career opportunities for Maryland graduates at [www.BeWhatIWantoBe.com](http://www.BeWhatIWantoBe.com).



**To support students in learning about careers, work-based learning opportunities are made available to all CTE students. Supervised work-based learning experiences allow high school students on-the-job training related to their career choice. Students may also elect to complete the work-based learning CTE program, *Career Research and Development (CRD)*. The program is designed to link the classroom with specific work experiences and includes two school-based courses followed by at least two work-based learning credits (generally in the last year of high school). These experiences are organized around a work plan that is cooperatively developed by the school and employer to add value to and extend a student's career preparation.**

# Sample High School Program of Study

Students electing to complete a CTE Program as part of the high school program are prepared for entry into college and a career pathway. The chart below shows a typical high school program of study that includes a CTE Program Sequence beginning in Grade 10. It also depicts how students can earn industry certification and/or college credit while in high school.

High School Program					College Program
Requirements	Grade 9	Grade 10	Grade 11	Grade 12	
English - 4	English 9	English 10	English 11 AP Language	English 12 AP Literature	<b>English/Language Arts</b> <i>Include AP credit options</i>
Social Studies - 3	US Government	World History AP European	US History AP US History	Government AP Govt.	<b>Humanities/Social Sciences</b> <i>Include AP credit options</i>
Mathematics - 4	Algebra I	Geometry	Algebra II	Trigonometry or Pre-Calculus or Calculus or AP Calculus	<b>Mathematics</b> <i>Include AP credit options</i>
Science - 3	Earth or Physical Science	Biology or AP Biology	Chemistry or AP Chemistry	Physics or AP Physics	<b>Science</b> <i>Include AP credit options</i>
Physical Education - .5 Health Ed - .5	.5 PE	.5 Health			
Fine Arts - 1	.5 Fine Arts	.5 Fine Arts			
Technology Education - 1	Foundations of Technology				
CTE Completer Program - 4		<b>CTE Program Sequence</b>			<b>CTE Program Concentration</b> Include articulation options • Dual Enrollment • Credit by Exam • Pre-Apprenticeship
		CTE Course (1)	CTE Course (1)	CTE Courses (2)	
Foreign Language - 2 and/or Advanced Tech Ed - 2	Foreign Language	Foreign Language	Foreign Language or Adv. Tech	Foreign Language or Adv. Tech	

In Maryland, all secondary and postsecondary programs are offered in related programs of study to advance student preparation and success in a career. However, specific program offerings vary by location. Contact the local school systems and/or community colleges who work together to identify areas of interest and program requirements.

In most CTE programs, the awarding of college credit and/or industry certification requires students to meet pre-determined standards and assessments as determined by the postsecondary institution and/or industry. A description of these requirements and opportunities for college credit and/or industry certification is included for each CTE program of study.



## Arts, Media and Communication

Maryland offers great opportunities for careers in the Arts, Media and Communication Career Cluster. Students interested in this cluster combine creative abilities with technical skills and knowledge that prepare them for careers in: Broadcast Production, Graphic Communications, Web Design, Interactive Media and Game Design. Maryland CTE programs include a focus on mass communication and broadcast journalism, graphic communication, and multimedia production. Working with people from the industry helps ensure that our programs keep pace with the industry. These programs include options for students to earn industry certifications and college credit toward advanced study in the career field.

### High School CTE Program

### CTE Program Description:

#### Communication and Broadcast Technology

*The Communication and Broadcast Technology program is currently under development. This program builds on current CTE programs and will provide students the opportunity to apply technical knowledge and skills to the production of radio, television and other media programs. Students will learn about media production and related operations including sound, video, film and digital media transmission. As part of the program, students may participate in an internship or mentored project related to the field of communication. Support for the development of this program is provided by Maryland Public TV, Maryland film industry partners, and Maryland colleges and universities.*

#### Graphic Communications (PrintED)

For more information about the Graphic Arts Education and Research Foundation and the PrintED program standards, please go to: [www.gaerf.org/printed](http://www.gaerf.org/printed)

*The Graphic Communications program is offered in partnership with the Printing and Graphics Association MidAtlantic (PGAMA). This program of study is designed to give students an overall understanding of the industry and its major operations while teaching academic and technical skills required in the field. Students can gain industry certification through PrintED in several areas, including; Introduction to Graphic Communication, Digital File Preparation, and Press Operations. While gaining the technical skills they need to succeed in this career pathway, students can also earn college credits through articulation agreements.*

#### Interactive Media Production

For more information about the related industry certifications for Adobe Creative Suite, please go to: [www.adobe.com](http://www.adobe.com)

*The Interactive Media Production program includes a strong foundation in arts and communication with particular emphasis on graphic and media communications, interactive technologies, and project development. Students complete two foundation courses in Arts, Media and Communication and Interactive Media Production before selecting one of two options for advanced study – Interactive Media Production or Simulation and Gaming.*

For more information about industry certification for web design and the World Organization of Webmasters, please go to: [www.joinwow.org](http://www.joinwow.org)

*In Interactive Media Production, students gain experience in Internet technology and website development, computer graphics, digital media production and project management. In Simulation and Gaming, students advance their understanding and skill level in computer game design and interactive programming. All students develop a portfolio of their work and may earn certification in Adobe Creative Suite or web design. Graduates may also earn articulated college credit.*



### Program Highlight: Graphic Communications (PrintED)

All 25 CTE Graphic Communications programs in Maryland have earned or will soon earn the Graphic Arts Education and Research Foundation's industry certifications in PrintED. Students earning certification are eligible for college credit through statewide articulation agreements.



## Business, Management and Finance

Maryland CTE programs include a focus on financial services, accounting, marketing, business management, and business administrative support services. These programs include options for students to earn industry certifications and college credit toward advanced study in the career field. Students have the opportunity to take the College Board “College-Level Examination Program (CLEP)” test in the areas of Financial Accounting, Principles of Management, and Principles of Marketing. Successful completion of these exams allow students to earn college credit for knowledge gained in their high school program.

### High School CTE Program

### CTE Program Description:

#### Academy of Finance (NAF)

For more information about the National Academy Foundation and the Academy of Finance, please go to: [www.naf.org](http://www.naf.org)

The National Academy Foundation (NAF) *Finance Academy* program prepares students for successful careers in finance, accounting and related fields. The *Finance Academy* provides students with a broad understanding of financial and economic concepts and provides internship opportunities. Students complete a series of courses including *Finance and Accounting, Economics, Banking and Credit, Securities and Insurance, Financial Planning, and International Finance*. In addition to an internship, students may also complete a college-level finance course during the senior year of high school.

#### Finance and Accounting

Students begin the program with courses in *Principles of Business, Administration, and Management* and *Financial Management*. Students learn effective decision making techniques, financial management, business communication skills, human resource management, problem solving, teamwork and networking skills. The final two courses in the program focus on *Finance and Accounting* where students become competent working with business transactions and financial reports. Graduates may earn college credit through articulation agreements with local colleges using a variety of options, such as dual enrollment and credit by exam.

#### Marketing

Students begin the program with courses in *Principles of Business, Administration, and Management* and *Financial Management*. The final two courses in the program focus on *Marketing* and prepare students for college-level programs. Students learn about marketing, the consumer’s role, research in global marketing, developing a marketing plan and ethics and social responsibility. Internships and mentored projects are highly recommended. Graduates may earn college credit through articulation agreements with local colleges using a variety of options, such as dual enrollment and credit by exam.

#### Business Administrative Services

For information about the industry certification, please visit: [www.microsoft.com/learning/mcpl/officespecialist/default.aspx](http://www.microsoft.com/learning/mcpl/officespecialist/default.aspx)

Students begin the program with courses in *Principles of Business, Administration, and Management* and *Financial Management*. The final two courses in the program focus on *Administrative Services* and prepare students for college-level programs. Graduates may also earn industry certification including Microsoft Office Specialist (MOS) or Microsoft Certified Applications Specialist (MCAS) certification.

#### Business Management

Students begin the program with courses in *Principles of Business, Administration, and Management* and *Financial Management*. The final two courses in the program focus on *Management*, including Entrepreneurship, and prepare students for college-level programs. Graduates may earn college credit through articulation agreements with local colleges using a variety of options, such as dual enrollment and credit by exam.



### Program Highlight: Academy of Finance

The National Academy of Finance (NAF) prepares students for careers in the financial services industry—accounting, banking, insurance, securities, and real estate, among others. The Academy is predicated on close partnerships with the local business community. In fact, students must complete an internship during their junior or senior year in order to graduate from the program. Achievement among NAF students is remarkable: In one school system, 100% graduate from high school, 95% meet the University System of Maryland’s entrance requirements, and 92% are in college or working after high school.



# Construction and Development

Advances in science and technology will continue to drive innovation in the design, construction, and maintenance of buildings and infrastructure, including new design concepts, construction materials and methods, and the application of information technology. Maryland high school construction-related programs allow students to advance their knowledge in specific construction trades, design or construction management.

## High School CTE Program

## CTE Program Description:

### Project Lead The Way: Civil Engineering and Architecture

For more information about Project Lead The Way, please go to: [www.pltw.org](http://www.pltw.org)

Students interested in a *Civil Engineering and Architecture* may enroll in the pre-engineering program *Project Lead The Way (PLTW)*, which is highlighted as part of the Manufacturing, Engineering Technologies Career Cluster (page 12). Students in the pre-engineering program may elect to take a specialization course in *Civil Engineering and Architecture*, in which they work in teams to develop community-based building projects and conceptual designs. Students completing the *PLTW* program may earn college credit in engineering programs throughout the country.

### Architectural Drafting and Design

For more information about Chicago Architecture Foundation, please go to: [architecture.org](http://architecture.org)

The *Architectural Drafting and Design* program is currently under development. The program will include instruction in construction and structural design, architectural rendering, architectural drafting and blueprint interpretation. As students progress through the program they complete all aspects of an industry-mentored design project. Additional curriculum resources and projects are available in partnership with the Chicago Architecture Foundation. Students completing this program may also participate in an internship and may earn articulated college credit.

### Construction Trades Professions

For more information on program standards, certification and the National Center for Construction Education and Research, please go to: [nccer.org](http://nccer.org)

The *Construction Trades Professions* programs are based on the National Center for Construction Education and Research (NCCER) standards and prepare students for further education and careers in the construction industry, with a focus on *Carpentry, Electrical, Plumbing, or Masonry*. Additional curriculum modules covering project management and project supervision as it relates to all areas of construction are offered as resources and support articulation to postsecondary Construction Management programs. Graduates meet Apprenticeship Training requirements and may earn industry certification and college credit through articulation agreements with community colleges.

### Construction Management

For more information on the National Center for Construction Education and Research, please go to: [nccer.org](http://nccer.org)

The *Construction Management* program is under development and based on the National Center for Construction Education and Research (NCCER) standards. This program will prepare students for further education and careers in the construction industry, with a focus on project management and project supervision as it relates to all areas of construction. Several Maryland community colleges offer articulated credit to postsecondary Construction Management programs.

### Construction Maintenance

For more information on program standards, certification and the National Center for Construction Education and Research, please go to: [nccer.org](http://nccer.org)

The *Construction Maintenance* programs are based on the National Center for Construction Education and Research (NCCER) standards and prepare students for further education and careers in the construction industry, with a focus on *Heating, Ventilating, Air Conditioning (HVAC); Industrial Maintenance; or Welding*. Additional curriculum modules covering project management and project supervision as it relates to all areas of construction are offered as supplemental resources and support articulation to postsecondary *Construction Management* programs. Graduates meet Maryland Apprenticeship Training requirements and may earn industry certification and college credit through articulation agreements with community colleges.

## Program Highlight: Construction Trades and Maintenance

Construction-related programs across the state are using the National Center for Construction Education and Research (NCCER) curriculum, resources and assessments to ensure student preparation and advancement in a wide range of construction careers. Industry partnerships across the state support Maryland students as they advance their technical and business knowledge through work-based learning opportunities and in many cases, through summer employment. Several of Maryland's community colleges use the NCCER standards, allowing easier transition from high school to college programs and apprenticeship.





## Consumer Services, Hospitality and Tourism

Programs in consumer services, hospitality and tourism prepare students for a variety of career options. Each program includes options for students to earn industry certifications and college credit in the career field. Students, who are interested in culinary arts, restaurant management, lodging management, or cosmetology, engage in real-world experiences through internships and mentoring opportunities. These allow students to apply their classroom instruction in meaningful ways, and they give them (through licensure or certification) a head start into the profession.

### High School CTE Program

### CTE Program Description:

#### Culinary Arts (ACF)

For more information about industry standards, certification and the American Culinary Federation, please go to: [www.acfchefs.org](http://www.acfchefs.org)

The *Culinary Arts* program partners with the American Culinary Federation (ACF) to prepare students for successful careers in the food and beverage industry, with a focus on *Culinary Arts* or *Professional Baking*. The program includes education in food production, professional cooking, baking, cost control, nutrition, sanitation and food marketing. When combined with science classes, this program will provide the necessary skills for further education and career success. Students may earn industry certification and credit toward becoming a Certified Culinarian (CC) or a Certified Pastry Culinarian (CPC).

#### Food and Beverage Management (ProStart)

For more information about industry standards, certification and the National Restaurant Association Educational Foundation, please go to: [nraef.org/prostart](http://nraef.org/prostart)

In partnership with the National Restaurant Association Educational Foundation (NRAEF), the *ProStart* program introduces students to a wide variety of careers within the restaurant, foodservice and hospitality industry. Students study and practice professional food preparation, international cuisines, food safety and sanitation, customer service relations, accounting, cost control, marketing and lodging management. As part of the program, students complete an industry-mentored work-based learning experience. Students may also earn industry certification and college credit.

#### Lodging Management Program

For more information about industry standards and the industry certification CRDS, please go to: [www.lodgingmanagement.org](http://www.lodgingmanagement.org)

The *Lodging Management Program* introduces students to careers within the lodging industry. Students study and experience multiple aspects of the lodging industry including the rooms division, general department and facilities management, marketing and sales, and food and beverage services. The American Hotel and Lodging Educational Institute (AHLEI) designed the program's curriculum and the Certified Rooms Division Specialist (CRDS) credential.

#### Academy of Hospitality and Tourism (NAF)

For more information about the National Academy Foundation and the Academy of Hospitality and Tourism, please go to [www.naf.org](http://www.naf.org)

In partnership with the National Academy Foundation (NAF), the *Academy of Hospitality and Tourism* prepares students for post-secondary education and careers in one of the world's largest service industries, hospitality and tourism. All students complete an internship along with courses in the Foundations of Hospitality, Hospitality Systems, Economics, and Management. In addition to an internship, students may also complete a college-level course during the senior year of high school.

#### Careers in Cosmetology

For more information about industry requirements and licensing in Maryland, please go to MD State Board of Cosmetology at [www.dlrr.state.md.us](http://www.dlrr.state.md.us)

The *Careers in Cosmetology* program prepares individuals to care for and beautify hair, skin and nails. Students are instructed in the art and science of cosmetology as well as all aspects of the industry. Emphasis is placed on hygiene, safety and sanitation as well as State Board of Cosmetologists' rules and regulations. Related areas of instruction include human anatomy and physiology; mathematics and measurement; analysis, diagnosis and histology of hair, skin and nails; chemistry; fundamentals of electricity; product knowledge; customer relations; and employability skills. Salon management is an integral part of the classroom and clinical experience. The 1,500 hour program includes classroom instruction, clinical experience, related mentored work-based learning experience and a senior capstone project. Upon successful completion of the program, the student will be required to take the Maryland State Board of Cosmetologists' Examination.



### Program Highlight: Culinary Arts

The American Culinary Federation (ACF) program prepares students for careers and further education in professional cooking or baking. Five Maryland high schools are accredited in culinary arts and professional baking—a one and a half year process that includes curriculum review, site visits, and assessments. Students completing the program earn points toward one of two industry credentials, Certified Culinarian or Certified Pastry Culinarian.



# Environmental, Agriculture and Natural Resources

The agricultural sector is a highly competitive global industry creating new challenges in identifying global and domestic markets; improving business planning, financing, risk management, and productivity; and reducing costs. Advances in science and technology, in particular biotechnology, will continue to drive innovation and growth in this career cluster. Growing public concerns over natural resources, environmental quality, and public health will continue to expand the role and scope of the natural resource management and environmental services sectors.

## High School CTE Program

### Horticultural Services: Certified Professional Horticulturist (CPH)

For more information about industry requirements, please go to Maryland Nursery and Landscape Association: [www.mnlaonline.org](http://www.mnlaonline.org)

## CTE Program Description:

The *Horticultural Services* program is based on requirements for the Certified Professional Horticulturist (CPH) certification used by the Maryland “Green Industry.” Students complete a sequence of courses including: Introduction to Environmental/Plant/Animal Science, Foundations of Horticulture, Plant Production, and Landscape Design and Management. Students have the opportunity to earn the Student-Level CPH certification by taking and passing the curriculum exam.

### Curriculum for Agriculture Science Education (CASE)

For more information, please go to [www.case4learning.org](http://www.case4learning.org)

The *Curriculum for Agriculture Science Education (CASE)* is under development and being field tested during the 2009-2010 school year. The program is a national curriculum project that offers students a rigorous curriculum designed to challenge students to perform at high levels. Through the use of activities, projects and problem-solving, students will explore agriculture subject matter while they learn necessary knowledge and skills. To establish these requirements, CASE incorporates the National Academic Standards and Agriculture Food and Natural Resources (AFNR) Content Standards. The program is a four-course sequence and will offer students the opportunity to earn college credit upon successful program completion.

### Environmental Studies/Natural Resources

The *Environmental Studies/Natural Resources* program is composed of a four-course sequence that covers both environmental and natural resource management technologies and current issues related to these fields of study. This program incorporates green construction and technologies and the impact of today’s environment on our natural resources. The program includes an emphasis on research and the ethics involved in making decisions that impact our ecosystem. Students will engage in technical research and writing as it relates to real-world problem solving. Students will also have the opportunity to earn college credit through articulation agreements with Maryland colleges.



### Program Highlight: Horticultural Services: Certified Professional Horticulturist (CPH)

In partnership with the Maryland Nursery and Landscape Association, CPH students complete a sequence of courses including: Introduction to Environmental/Plant/Animal Science, Foundations of Horticulture, Plant Production, and Landscape Design and Management. Students have the opportunity to earn student CPH certification by taking and passing the curriculum exam.

## Health and Biosciences

Career and Technology Education programs in the Health and Biosciences Cluster focus on preparing dedicated professionals with the knowledge and skills necessary to pursue challenging and rewarding careers and further education. These programs require students to apply knowledge learned in science and mathematics to professions in the Health and Biosciences field. These careers are among the fastest growing and highest in demand in the country as the population ages and health care needs continue to increase. These CTE programs prepare students for positions in direct patient care settings, research and laboratory facilities, as well as for opportunities in business and management related to health care. The Health and Biosciences Cluster also provides career development experiences for students who want to pursue careers in the medical professions including physicians, research scientists, nurses, and a wide variety of exciting careers.



### High School CTE Program

#### Academy of Health Professions (AOHP)

For more information about requirements in the field of Health Care, please visit the Maryland Board of Nursing website at: [www.mbon.org](http://www.mbon.org)

### CTE Program Description:

The *Academy of Health Professions* program uses project and problem-based learning, clinical experiences, as well as classroom and lab instruction to teach students about the field of health care. Students progress through two foundation courses: *Foundations of Medicine and Health Science* and *Structure and Functions of the Human Body*. Opportunities for students to apply what they are learning to real-life health care situations are part of a specialized health care course and a scientific research course. Students will also have the opportunity to earn state and/or nationally recognized certifications, and/or college credit through articulation agreements with local colleges.

#### Biomedical Sciences: Project Lead The Way

For more information about Project Lead The Way, please go to: [www.pltw.org](http://www.pltw.org)

The Project Lead The Way (PLTW) *Biomedical Sciences* program is based on the National Standards for Science, Mathematics, and English Language Arts, and the Accountability Criteria for the National Health Care Cluster Foundation Standards. The program consists of a sequence of four courses: *Principles of the Biomedical Sciences*, *Human Body Systems*, *Medical Interventions*, and *Biomedical Innovations*. Students who complete the program are prepared for employment and further education at two- and four- year college levels.

#### Project Lead The Way: Biotechnical Engineering

For more information about Project Lead The Way, please go to: [www.pltw.org](http://www.pltw.org)

Students interested in a *Biotechnical Engineering* may enroll in the pre-engineering program *Project Lead The Way (PLTW)*, which is highlighted as part of the Manufacturing, Engineering Technologies Career Cluster (page 12). Students in the pre-engineering program may elect to take a specialization course in *Biotechnical Engineering*, in which students apply biological and engineering concepts related to biomechanics, genetic engineering, and forensics. Students completing the *PLTW* program may earn college credit in engineering programs throughout the country.

### Program Highlight: Biomedical Sciences

Maryland is one of the first states in the country to implement the Biomedical Sciences program developed by Project Lead the Way. Several school systems in Maryland are offering the program with great success. Instructors in the program report that their students are very engaged in and highly motivated by the structure and content of the program. The PLTW Biomedical Sciences program is a problem and project based curriculum where students work to solve real-world problems using scientific methods and research techniques. The science content of the first course reinforces what students are learning in Biology. The goal of the PLTW program is to produce an increasing and more diverse group of students to be successful in science, engineering and biotechnology programs at the four and two year college level. Students enrolled in the program take the following sequence of courses: *Principles of the Biomedical Sciences*, *Human Body Systems*, *Medical Interventions* and *Bionmedical Innovations*. Stevenson University provides professional development to teachers of the Biomedical Sciences program as the state's university affiliate.



There are 360 bioscience companies in Maryland, a 65% growth over 1998. Those companies employ more than 23,000 people.

*Taking Care of Business:  
Bioscience in Maryland  
MdBio, 2007*



## Human Resource Services

Advances in scientific knowledge, and increased public awareness of social problems and issues are contributing to a demand for high-quality social services. Public concerns over crime, security, and emergency response and the increased demand for legal intervention in business and communities will continue to drive the growth of law enforcement, emergency and legal services. The continuous need for education professionals, especially in the critical shortage areas, offers creative ways to engage young people early on in the teaching profession.

### High School CTE Program

#### Fire Science: Maryland Fire and Rescue Institute (MFRI)

For more information about the Maryland Fire and Rescue Institute, go to: [www.mfri.org](http://www.mfri.org)

#### Homeland Security and Emergency Preparedness:

- Homeland Security Sciences
- Criminal Justice and Law Enforcement
- Information and Communications Technology

For more information about the STARS GIS Technician Certification, please go to: [mset.org/stars\\_certify.php](http://mset.org/stars_certify.php)

#### Legal Support Services

#### Childcare and Early Childhood Education

#### Teacher Academy of Maryland (TAM)

For more information about teaching requirements go to : [www.marylandpublicschools.org](http://www.marylandpublicschools.org)

For more information about the ParaPro certification, please visit: [www.ets.org](http://www.ets.org)

### CTE Program Description:

The *Fire Science* program is offered in partnership with instructors from the Maryland Fire and Rescue Institute (MFRI) of the University of Maryland. Students progress through courses on fire prevention and control and emergency medical technology. The program includes classroom instruction as well as formal training at local fire companies. Students are required to complete work-based learning and take the seven certification exams.

The *Homeland Security and Emergency Preparedness (HS/EP)* program prepares students for industry certification and college credit in one of three areas: *Homeland Security Sciences, Criminal Justice and Law Enforcement, or Information/Communications Technology*. All students complete a foundation-level course with a focus on protecting against threats to public safety through effective communication, preparedness, detection, prevention, response and recovery. Students completing *Homeland Security Sciences* program complete additional courses in *Homeland Security Science Research Methods and Applications*. Students completing *Criminal Justice and Law Enforcement* complete an additional course in *Administration of Justice* and participate in an internship as part of the program. Students in the *Information/Communications Technology* courses focus on Geographic Information System (GIS) and Remote Sensing (RS) technology leading to the *STARS Entry-Level GIS Technician Certification*.

The *Legal Support Services* program is currently under development. This program will provide an overview of law, legal terminology and documentation, research, court related services and professional standards and ethics. This program will prepare students for legal services and for college law-related programs.

The *Childcare and Early Childhood Education* program provides an overview of learning theory and practice with an emphasis on early childhood. This program will prepare students to teach students ranging in age from infancy through eight years. Students will also have the opportunity to earn industry certification and college credit.

The *Teacher Academy of Maryland* program prepares students for further education and careers in the education profession. The program focuses on human growth and development through adolescence, teaching as a profession, curriculum and instruction and an education academy internship. Upon completion of the program and passing the ParaPro test or PRAXIS I, high school graduates are ready for employment in the teaching profession. This program is based on the outcomes of the Maryland Associate of Arts in Teaching (A.A.T.) degree, which aligns with the National Council for the Accreditation for Teacher Education standards.



### Program Highlight: Teacher Academy of Maryland (TAM)

The Teacher Academy of Maryland (TAM) introduces students to the teaching profession and gives them a jump on college coursework. TAM students can enroll directly in a four-year college with a teacher education program, netting credit for their high school program. Or they can enroll in any of the 13 community colleges statewide that offer the articulated Associate of Arts in Teaching degree—a two-year degree whose coursework transfers to any in-state 4-year college (public or private) with a teacher-preparation program. Towson University, which graduates about one in every four teacher candidates—far more than any other college in Maryland—is the state's program partner, offering both transcripted credit and scholarships to TAM graduates.

# Information Technology

Information technology professionals will face increasing pressure to design, develop, implement, and support more complex and reliable information technology solutions that will meet the needs of external and internal customers. This will require that information technology professionals have the skills to determine customer and business needs and requirements, manage complex projects, and integrate software and hardware solutions. Maryland CTE programs include opportunities for students to focus on software development, programming or to place greater emphasis on developing knowledge and skills related to IT hardware and networking technologies.



## High School CTE Program

### Academy of Information Technology (NAF)

For more information about the National Academy Foundation and the Academy of Information Technology, please go to: [www.naf.org](http://www.naf.org)

### Database Academy (Oracle)

For more information about the Oracle Academy and Oracle certifications, please go to: [www.academy.oracle.com](http://www.academy.oracle.com)

### IT Networking Academy (CISCO)

For more information about the Cisco Academy and Cisco certifications, please go to: [www.cisco.com](http://www.cisco.com)

## CTE Program Description:

In partnership with the National Academy Foundation (NAF), the *Academy of Information Technology* prepares students for post-secondary education and careers in a wide range of Information Technology (IT) careers. All students complete foundation-level courses in computer science and then choose an area of specialization. Students may focus on IT software and programming or IT hardware and networking options.

The *Database Academy (Oracle)* program prepares students for successful careers in database administration, database programming, IT consulting, IT project management, and computer engineering. The Oracle Academy is a two-year program that includes database programming, as well as the professional skills students require to pursue quality academic and professional opportunities. Each course of the Oracle Academy prepares students for the Oracle Certified Associate (OCA) certification.

The *IT Networking Academy (Cisco)* prepares students for advanced study in IT and for industry certification (CCNA), the first step in a Cisco career certification path. Students learn how to install and configure switches and routers in multiprotocol networks using local- and wide-area networks; provide troubleshooting service; and improve network performance and security. The high school program for the IT Networking Academy starts with a foundation in computer hardware and software basics. Students advance their understanding of IT Networking through the Cisco Academy with the opportunity for a range of industry certifications, such as CompTIA (A+, Net+) and Cisco CCENT.



## Program Highlight: IT Networking Academy (Cisco)

The IT Networking Academy (Cisco) prepares students for advanced study in a wide range of IT careers, including networking, cabling and wireless technologies. More than 3,000 students are enrolled in Cisco Academies across Maryland at the high school and college level.



## Manufacturing, Engineering, and Technology

Programs in the Manufacturing, Engineering, and Technology Cluster prepare students for a variety of career options through Maryland's Career and Technology Education Programs of Study that lead to postsecondary education and employment. These include opportunities to become engineers, engineering technologists, engineering and manufacturing technicians; and related fields, such as product engineering and manufacturing sales and service. Students engage in real-world projects that strengthen their understanding of science, technology, engineering, and mathematics (STEM). They work in specialized and cross-functional teams to complete challenging projects related to design, manufacturing process applications, supply chain logistics, and quality improvements. Graduates are being educated for the high-performance workplace of advanced technologies that are common in the 21st century. Employers in the manufacturing and engineering sectors need a pipeline of highly qualified employees to remain internationally competitive, to develop and use new technologies, and to continuously improve the quality of life for Marylanders.

### High School CTE Program

### CTE Program Description:

#### Pre-Engineering: Project Lead The Way (PLTW)

For more information about Project Lead The Way, please go to:  
[www.pltw.org](http://www.pltw.org)

The Pre-Engineering: Project Lead The Way (PLTW) program prepares students for further education and careers in engineering and engineering technology. Students complete foundation-level courses in Engineering, including *Principles of Engineering*, *Introduction to Engineering Design*, and *Digital Electronics*. Students then select an area of specialization, including *Computer Integrated Manufacturing*, *Civil Engineering and Architecture*, *Aerospace Engineering* or *Biotechnical Engineering*. In the final course, students also complete an industry-mentored capstone project in Engineering Design and Development.

#### Manufacturing Engineering Technologies

The *Manufacturing Engineering Technologies* program is designed to prepare students for the manufacturing industry and includes a focus on Manufacturing Process Design and Development, Production, Supply Chain Logistics, Health, Safety and Environment, and Quality Assurance and Continuous Improvement. Course content aligns with Maryland Manufacturing, Engineering and Technology career cluster pathway definitions and the standards outlined in the United States Department of Labor's Framework of Competencies for the Advanced Manufacturing Industry. The focus is applying lean methodology and tools to effectively implement continuous improvement for success in a global, competitive business environment.



### Program Highlight: Project Lead The Way

Maryland's Project Lead The Way (PLTW) program is a sequence of courses which, when combined with traditional mathematics and science courses in high school, introduces students to the scope, rigor, and discipline of engineering and engineering technology prior to entering college. There are eight courses in the PLTW program which are divided into three groups: Foundation (Principles of Engineering, Introduction to Engineering Design and Digital Electronics); Pathway (Computer Integrated Manufacturing, Civil Engineering and Architecture, Aerospace Engineering and Biotechnical Engineering); and Capstone (Engineering Design and Development). Students in the Project Lead The Way pre-engineering program take all of the foundation courses, one pathway course, and the capstone course. Students can earn credit at PLTW-affiliated colleges and universities nationwide, including the University of Maryland-Baltimore County, the state's university affiliate.



## Transportation Technologies

Advances in science and engineering are producing major innovations in transportation technology, resulting in faster movement of people and goods at lower costs and with less environmental and safety risks. These innovations require higher skills to manage and maintain transportation equipment. High school programs provide opportunities for students to prepare for careers in the automotive industry or to explore aerospace engineering opportunities.

### High School CTE Program

#### Automotive Technician (NATEF)

For more information about the National Automotive Technicians Education Foundation (NATEF) standards and industry certification, please go to: [www.natef.org](http://www.natef.org)

#### Autobody/Collision Repair Technician (NATEF)

For more information about the NATEF, please go to: [www.natef.org](http://www.natef.org)  
For information about the Inter-Industry Conference on Auto Collision Repair, please go to: [www.i-car.com](http://www.i-car.com)

#### Medium-Heavy Truck Technician (NATEF)

For more information about the NATEF standards and industry certification, please go to: [www.natef.org](http://www.natef.org)

#### Project Lead The Way: Aerospace Engineering

For more information about Project Lead The Way, please go to: [www.pltw.org](http://www.pltw.org)

### CTE Program Description:

The *Automotive Technology* program incorporates the Automotive Service Excellence (ASE) program certification standards and the National Automotive Technicians Education Foundation (NATEF) standards. The program consists of four courses: *Suspension and Steering, Brakes, Electrical/Electronic Systems, and Engine Performance*. Each course is aligned to Industry requirements for certification and success in the field. The end-of-course assessment provides students the opportunity to earn ASE student achievement recognition certification and college credit.

The *Autobody/Collision Repair Technician* program combines technical, academic and workplace skills in an integrated curriculum in accordance with the Inter-Industry Conference on Auto Collision Repair (I-CAR), National Automotive Technicians Education Foundation (NATEF), and Automotive Service Excellence (ASE) guidance and directives. The program consists of the following courses: *Non-Structural Analysis & Damage Repair, Paint and Refinishing, and Structural Analysis and Damage Repair*. Each course has a NATEF end-of-course assessment providing students the opportunity to earn ASE student achievement recognition certification and college credit.

The *Medium/Heavy Truck Technician* program combines technical, academic and workplace skills in an integrated curriculum in accordance with all National Automotive Technicians Education Foundation (NATEF) guidance and directives. The program consists of the four required areas of study including; *Suspension and Steering, Brakes, Electrical/Electronic Systems, and Preventive Maintenance*. NATEF end-of-course exams will be available starting Spring 2010.

Students interested in a *Aerospace Engineering* may enroll in the pre-engineering program *Project Lead The Way (PLTW)*, which is highlighted as part of the Manufacturing, Engineering Technologies Career Cluster (page 12). Students in the pre-engineering program may elect to take a specialization course in *Aerospace Engineering*, in which they apply scientific principles and concepts to design materials and processes that directly measure, repair, and improve systems in different environments. Students completing the *PLTW* program may earn college credit in engineering programs throughout the country.



### Program Highlight: Automotive Technician

Maryland is fourth in the nation in the percentage of students taking the National Automotive Technicians Education Foundation (NATEF) end-of-program exam. Passing this exam earns students college credits and Automotive Service Excellence (ASE) student achievement recognition certification.

—Don Dew, Executive Director, Special Projects, NATEF

## CAREER AND TECHNOLOGY EDUCATION



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