Attachment A

**Montgomery County Public Schools**
**Governor's STEM Academy**

**Executive Summary**
**May 6, 2013**

| | |
|---|---|
| Partnership Members: | Montgomery County Public Schools, Virginia Tech, Montgomery County Department of Economic Development, New River Community College, Jeld-Wen Interior Doors, Automation Creations, OWPR Architects and Engineers, Moog Components Group, NRV Competitiveness Center |
| Lead Entity and Fiscal Agent: | Montgomery County Public Schools |
| Contact Person: | Rick Weaver<br>CTE Supervisor<br>Montgomery County High School<br>750 Imperial Street, SE<br>Phone: 540 382-5100 Ext. 1048<br>Fax: 540 381-6127 |
| Academy Location: | Christiansburg High School |
| Number Students: | The Governor's STEM Academy will have the capacity to enroll 150 students, grades 9 – 12. During the initial school year (2013–2014) 65 students will be admitted. |
| Career Pathways: | Engineering and Technology<br>Information Support and Services<br>Manufacturing Production Process Development<br>Network Systems<br>Production<br>Programming and Software Development |
| Academy Goals and Performance Measures: | The goal of the Montgomery County Public Schools Governor's STEM Academy is to promote student achievement and interest in STEM career fields to prepare students for global competitiveness in high-skill, high-wage, and high-demand STEM careers.<br><br>The following program objectives and performance measures have been established by the Planning/Advisory Committee:<br>• Increase the percentage of Governor's STEM Academy students taking Algebra II by <u>four percent over the next four years.</u><br>• Increase the percentage of Governor's STEM Academy students scoring pass/advanced on mathematics and science end-of-course Standards of Learning <u>tests by four percent over the next four years</u>.<br>• Increase the number of postsecondary credits earned through dual enrollment, |

Advanced Placement courses, and the Jumpstart program by five percent over the next four years.

- Provide annually, one hundred percent of the Governor's STEM Academy students with workplace readiness experiences, through strong partnerships with local businesses.
- Increase the graduation rate for Christiansburg High School by four percent over the next four years.
- Reduce the dropout rate for Christiansburg High School by two percent over the next four years.
- Increase enrollment and retention in postsecondary education by giving Governor's STEM Academy students the opportunity to earn dual enrollment credit (see bullet number three above) and by providing at least three opportunities annually for Governor's STEM Academy students and their parents to learn about postsecondary opportunities available at New River Community College, Virginia Tech and other postsecondary institutions. After high school, Governor's STEM Academy students will complete the Career and Technical Education follow-up survey to determine successful enrollment and retention in postsecondary institutions.
- Increase the number of students completing a college and career readiness curriculum in high school by increasing enrollment and completion rates in Montgomery County Governor's STEM Academy courses by five percent annually.
- Reduce the number of students requiring remediation in college by five percent annually. The Montgomery County Governor's STEM Academy director will work with the career coach at Christiansburg High School and New River Community College to obtain the results for Montgomery County Schools from the Virginia Placement Test to determine both baseline data and successful attainment of the performance measure. It does need to be noted that after disaggregating testing, discipline, and attendance data, the administrative and curriculum teams at Christiansburg High School have recommended a change to the scheduling procedure for rising ninth graders. The new schedule will allow more time to focus on core academic areas, especially Algebra I. This change should provide the students with a firmer academic foundation and make the transition to high school easier, which will hopefully decrease the need for postsecondary remediation and help to increase the graduation rate.
- Increase the number of industry certifications awarded to Governor's STEM Academy students by five percent over the next four years.
- Increase the number of Governor's STEM Academy graduates employed in high-wage, high-demand, and high-skill careers as determined by the Virginia Employment Commission by five percent over the next five years. The attainment of the measure will be determined by data provided by the Career and Technical Education follow-up survey and data provided by New River Community College.

Highlights of the Program: As a result of participating in the Governor's STEM Academy in the pathways of Engineering and Technology, Information Support Systems, Manufacturing Production Process Development, Network Systems, Production, Programming and Software Development, students will:

- Gain a deeper understanding of the skills and knowledge incorporated in their

fields of study;

- Benefit from specialized, project-based courses which develop critical-thinking, problem-solving, and decision-making skills, preparing them for the 21st century world;
- Acquire greater communication skills;
- Develop workplace readiness skills;
- Receive opportunities to earn industry certifications preparing them to be more competitive in the work force and when applying to advanced training schools or postsecondary institutions;
- Obtain meaningful, real-life, hands-on experiences in their career pathway; and
- Profit from opportunities for internships, mentorships, job shadowing, and cooperative education, which provide students with advantages when entering postsecondary education and/or the workplace.

Attachment B

**The State Council of Higher Education for Virginia (SCHEV)**

Review of the Governor's STEM Academy – Montgomery County Public Schools

NOTE: The SCHEV staff is currently reviewing the proposal. The report and recommendation will be provided prior to the final review of the proposal by the Board of Education.

Attachment C

# Virginia Department of Education
# Governor's STEM Academy
# Proposal Review Checklist

**Title of Proposal: Montgomery County Governor's STEM Academy**

**Lead Entity for Proposal: Montgomery County Public Schools**

**Date of Review: May 7, 2013**

# Virginia Department of Education
# Governor's STEM Academy
# Proposal Review Checklist

## I. Partnership Capacity

**Partnerships desiring to implement a Governor's STEM Academy shall provide the Department of Education with evidence of the following:**

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| A. An active, ongoing planning committee, including a list of members and signed certifications from each that they are willing and able to serve in that capacity. At a minimum, members must represent K-12 education (superintendent or designee), higher education, and business and industry. All partners must be represented on the committee. | X | | | |
| B. An advisory committee, including a list of members and signed certifications from each that they are willing and able to serve in that capacity. | X | | | |
| C. A written memorandum of agreement among school divisions, local businesses, postsecondary institutions, and any other partners that outlines ways in which community resources will contribute to the Governor's STEM Academy to broaden the scope of students' educational experiences. | X | | | |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| D. A statement of assurances that the Governor's STEM Academy Planning Committee has reviewed provisions of *Administrative Procedures Guide for the Establishment of Governor's STEM Academies* and agrees to follow the guidelines set forth in the document (see appendix). | X | | | |
| E. A statement of assurances that, if applicable, an ongoing Governing Board will be established to reflect current Board of Education regulations relative to jointly operated schools and programs (see appendix). | X | | | |
| Comments: | | | | |

## II. Need/Rationale for the Academy

## Partnerships desiring to implement a Governor's STEM Academy shall provide the Department of Education with evidence of the following:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| A. Demonstration of the need/rationale for the Academy. This statement should be concise and state the major reasons to have a Governor's STEM Academy, including need at the state, local and/or regional levels. | X | | | |
| B. A description of the enhanced or additional offerings in science, technology, engineering, and/or mathematics (STEM) that will meet the need described above. | X | | | |
| C. A fiscal agent that is a public entity, including a certification that the entity is willing and able to serve in that capacity. | X | | | |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| Comments: | | | | |

## III. Program Description

**Each Governor's STEM Academy planning committee shall develop cooperatively with local school divisions, business, community, and higher education partners and have available for review and dissemination, a program description that includes:**

### A. A statement of program goals addressing the following criteria:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| 1. Rigorous academic content in career and technical instruction; | X | | | |
| 2. An emphasis on STEM career pathways; | X | | | |
| 3. Individualized high school plans to ensure course selections that are aligned with students' transition and career goals after high school; | X | | | |
| 4. Evidence that graduates will complete a college and work readiness curriculum, minimally at the level specified for Commonwealth Scholars Course of Study (State Scholars Core) with the possibility of pre-approved substitution of equivalent courses where there may be more relevant course selections for a particular career pathway; | X | | | |
| 5. Incorporation of Virginia's Workplace Readiness Skills. | X | | | |
| Comments: | | | | |

## B. A statement of program objectives and performance measures to:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| 1. Improve academic achievement of Academy students; | X | | | |
| 2. Increase completion of dual enrollment courses; | X | | | |
| 3. Provide workplace readiness experiences for students through strong partnerships with businesses; | X | | | |
| 4. Increase high school graduation rates; | X | | | |
| 5. Reduce dropout rates; | X | | | |
| 6. Increase enrollment and retention in postsecondary education; | X | | | |
| 7. Increase the proportion of students completing a college and workplace ready curriculum in high school; | X | | | |
| 8. Reduce the proportion of students requiring remediation in college; | X | | | |
| 9. Increase the number of industry certifications awarded to high school students; and | X | | | |
| 10. Increase the number of graduates employed in high-wage, high-demand and high-skill careers. | X | | | |
| Comments: | | | | |

## C. A brief description of the proposed program, including:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| 1. Site location; | X | | | |
| 2. Number of students to be served; | X | | | |
| 3. Grade levels; | X | | | |
| 4. General curriculum design; | X | | | |
| 5. List of courses to be delivered; | X | | | . |
| 6. Description of how/where the courses will be delivered. Courses may be delivered on a high school, technical center or community college campus, online, or in other innovative ways; and | X | | | |
| 7. Designation of full-day or part-day, academic-year program. | X | | | |
| Comments: | | | | |

## D. Evidence of participation in the Governor's Exemplary Standards Award Program for Career and Technical Education

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | . |
| Comments: | | | | |

## E. Program and course descriptions

### E.1. At least two well-articulated career pathways must be included that meet the following criteria:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| **Pathway #1** | | | | |
| a. Must include opportunities to earn industry credentials, postsecondary certificates, diplomas or associate degrees while in high school and pursue additional industry credentials and academic degrees at the associate, bachelor's and graduate levels. These pathways may be in the same or different career clusters. | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| b. Must be in a field identified by a statewide authority or organization, such as the Virginia Economic Development Partnership or the Virginia Research and Technology Advisory Commission, as a strategic growth area for Virginia. Examples include biosciences, information technology, automotive technology and motor sports, as well as modeling and simulation and nanotechnology **or** | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| c. Must address regional and local work force demand in a high-wage, high-skill field as identified by employers and work force officials. | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| d. At least one pathway must be in a STEM-related field. This career pathway should drive the innovative capacity of the region and/or state. | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| Comments: | | | | |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| **Pathway #2** | | | | |
| a. Each career pathway must include opportunities to earn industry credentials, postsecondary certificates, diplomas or associate degrees while in high school and pursue additional industry credentials and academic degrees at the associate, bachelor's and graduate levels. These pathways may be in the same or different career clusters. | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| b. Must be in a field identified by a statewide authority or organization, such as the Virginia Economic Development Partnership or the Virginia Research and Technology Advisory Commission, as a strategic growth area for Virginia. Examples include biosciences, information technology, automotive technology and motor sports, as well as modeling and simulation and nanotechnology, or | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| c. Must address regional and local work force demand in a high-wage, high-skill field as identified by employers and work force officials. | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| d. Of the two pathways described, at least one must be in a STEM-related field. This career pathway should drive the | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| innovative capacity of the region and/or the state. | | | | |
| e. Additional career pathways may address one of the areas described above, or an area identified by the partnership as an area of interest, growth, or expansion for students in the service area of the Academy. | | X | | Specific courses for the sample plans of study must show opportunities for students to complete a program sequence. |
| Comments: | | | | |

## E.2 List of all requirements for successful program completion.

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

## E.3 Academy graduates must achieve one or more of the following benchmarks:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| a. Earn one or more industry certifications or state occupational licenses, and/or demonstrate competencies on an assessment instrument recognized by postsecondary institutions such as CLEP examinations, collaboratively designed or mutually approved end-of-course tests, college placement tests, or student portfolios reviewed by a team of college and high school faculty; **or** | X | | | |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| b. Earn at least 9 transferable college credits as defined in the Early College Scholars program (includes dual enrollment, AP and other options); **or** | X | | | |
| c. Earn an Associate Degree. | | | | |
| Comments: | | | | |

## E.4 Significant work-based experience must be included representing additional instruction or training beyond the classroom such as:

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| a. Cooperative Education; or | | | | |
| b. Internships; or | X | | | |
| c. Job Shadowing; or | X | | | |
| d. Mentorships; or | X | | | |
| e. Project-based learning; or | X | | | |
| f. Service learning; or | X | | | |
| g. A combination of the above. | | | | |
| Comments: | | | | |

**F. Length of program and daily schedule: Governor's STEM Academies are defined by program content, not by the location or delivery system of courses. Evidence of the following must be submitted:**

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| Designation of full-day or part-day, academic-year program. | X | | | |
| Comments: | | | | |

**G. Assurance from the fiscal agent that operating funds and facilities are available to support the Governor's STEM Academy and are adequate to meet the needs of the program**

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments:<br>. | | | | |

**H. Materials and equipment to be provided to accomplish program goals and objectives.**

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments:<br>. | | | | |

**I. Evidence of an internal evaluation process to effect program improvement, including:**

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| 1. A review of the Academy's policies, procedures, and outcomes; | X | | | |
| 2. Consideration of feedback from students, staff, parents, the | X | | | |

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| community, and partnership members; and | | | | |
| 3. Annual collection and reporting of data to the Department of Education related to student achievement, goal achievement, and other indicators. | X | | | |
| Comments: | | | | |

## IV. Administrative Procedures

Each Governor's STEM Academy must develop and maintain procedures developed cooperatively with participating partners. There should be evidence of procedures in the four areas that follow.

### A. Partnerships - The role of business and industry, public school divisions, and postsecondary institutions in the partnership. The role of workforce and economic development entities should also be included if they are among the partners.

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

### B. Student recruitment, selection criteria, and admissions.

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

**C. Code of student conduct and attendance.**

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

**D. Transportation provided by the school division or consortium that is in compliance with all applicable federal and state regulations.**

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

**E. Staff recruitment, selection, and assignment - The Governor's STEM Academy shall hire staff members who meet the Virginia teacher licensure requirements and/or postsecondary faculty qualifications. Where applicable, they must have industry-specific education with training and experience, including industry certification.**

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

**F. Staff development - The program will provide appropriate staff training in addition to staff planning time.**

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

## G. Staff evaluation – Staff will be evaluated according to the human resources policies of the agency or institution employing Academy personnel.

| | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| | X | | | |
| Comments: | | | | |

## H. Parent, student and community involvement

| Criteria | Documentation | | | Comments |
|---|---|---|---|---|
| | Full | Partial | None | |
| 1. Preparation for entering the Academies should begin by eighth grade. | X | | | |
| 2. Students, parents, teachers, and counselors should work collaboratively to:<br>a. Complete career interest inventories; | X | | | |
| b. Prepare academic and career plans outlining an intended course of study in high school; | X | | | |
| c. Review multiple postsecondary pathways and the steps required to pursue them; | X | | | |
| d. Participate in career assessments to identify areas students should strengthen to qualify for their selected pathways; and | X | | | |
| e. Discuss available diplomas, seals, and other recognitions including admission to specialized programs such as Governor's Academies. | X | | | |

## I. Documentation of insurance, budget, and other fiscal information

| | Documentation | | | Comments |
|---|---|---|---|---|
| | **Full** | **Partial** | **None** | |
| Insurance | X | | | |
| Budget (from appendix) | X | | | |
| Budget Narrative | X | | | |
| Other | | | | |
| Comments: | | | | |

ATTACHMENT D

Montgomery County Public Schools

# GOVERNOR'S STEM ACADEMY APPLICATION

## MAY 23, 2013

# TABLE OF CONTENTS


## I. RATIONALE

A. Demonstration of Need 4
B. Description of Enhanced Offerings to Meet Need 6
C. Fiscal Agent 7

## II. PARTNERSHIP CAPACITY

A. Planning Committee 7
B. Advisory Committee 8
C. Memorandum of Agreement / Partnership Agreement 8
D. Statement of Assurances- Administrative Procedures 8

## III. PROGRAM DESCRIPTION

A. Program Goals 8
B. Program Objectives and Performance Measures 9
C. Description and Program/School Population Profile 10
D. Governor's Exemplary Standards Award Details 11
E. Sequence of Proposed Program and Course Descriptions 11
E.1 Career Pathways 11
E.2 Requirements for Program Completion 15
F. Length of Program, Daily Schedule 15
G. Fiscal Agent Assurance of Funding and Facilities 15
H. Materials and Equipment 15
I. Internal Evaluation 16

## IV. ADMINISTRATIVE PROCEDURES

A. Partnerships 16
B. Student Recruitment, Selection Criteria, and Admissions 17
C. Student Code of Conduct 18
D. Transportation 18
E. Staff Recruitment 18
F. Staff Development 18
G. Staff Evaluation 19
H. Parent, Student, and Community Involvement 19
I. Insurance, Budget, and other Fiscal Information 19

## APPENDICES

A. Employment by Sector- Montgomery County

B. Industries in the New River Community College Region

C. Jobs by Occupation Group, New River Community College Region

D. Dual Enrollment Agreement

E. Planning Committee Members

F. Advisory Committee Members

G. Memoranda of Agreement / Partnership Agreements

H. Statement of Assurances

I. Exemplary Standards Award Checklist

J. Course Descriptions

K. Academy Course Framework

L. Governor's STEM Academy Bell Schedule

M. Plans of Study

N. Certificate of Insurance

O. Budget

# MONTGOMERY COUNTY PUBLIC SCHOOLS' GOVERNOR'S SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) ACADEMY PROPOSAL

**May 2013**

## I. RATIONALE

### A. Demonstration of Need

Manufacturing and technology businesses have been a robust segment of the economy in Montgomery County that continues to grow. 12.1 percent of Montgomery County's work force is currently employed in manufacturing and another 5.4 percent in scientific and technical services *(See Appendix A Employment by Sector).* The number of technology companies located in Montgomery County has seen exponential growth due largely to the presence of Virginia Tech and the affiliated Corporate Research Center (CRC). The CRC campus continues to expand and has influenced the presence of many new technology companies, further increasing the local need for STEM workers. Virginia Employment Commission data indicates that the manufacturing industry employs the second largest number of all industries and ranks fifth in the current number of advertised job openings in the New River Community College service region *(see Appendix B Industries in the New River Community College Region).*

Montgomery County is the largest county served by New River Community College. Jobs related to STEM, Manufacturing, and Information Technology career clusters are in the top ten of occupation groups represented by jobs advertised in the same region. The increasing technological scope of local business and industry requires employees in the following Career Pathways:

- Engineering and Technology
- Manufacturing Production Process Development
- Production
- Programming and Software Development
- Information Support and Services
- Network Systems

Both Virginia Employment Commission data and conversations with local industry leaders indicate that demand exceeds the number of well-trained applicants in the occupations

represented by these pathways. This need will be addressed in the proposed Governor's Academy *(see Appendix C Jobs by Occupation Group New River Community College Region).*

Postsecondary education and training opportunities for STEM education are available locally at New River Community College, Virginia Western Community College, Radford University and Virginia Tech. Many of the STEM programs in these institutions report ongoing efforts to maintain enrollments at full student capacity. One objective of the STEM Academy will be to ensure that Academy graduates help fill the excess capacity in these local programs.

The nationwide need for improved STEM education for America's high school students has been much discussed and well-documented in recent years. In its July 2010 article, *Supporting Science, Technology, Engineering and Mathematics Education,* the U.S. Department of Education states that, "Mastery of mathematics, science, and technology is no longer only for future scientists and engineers; it is essential preparation for all students. Despite an overall increase in postsecondary education enrollment for over a decade, the percentage of STEM college graduates has declined. America needs to increase the number of students pursuing STEM fields in their academic studies and careers, and improve preparation for the next generation of engineers, scientists, mathematicians, and technicians."

According to the U.S. Department of Commerce report, *STEM: Good Jobs Now and for the Future,* in the past ten years, growth in STEM jobs was three times as fast as growth in non-STEM jobs, and STEM workers are less likely to experience joblessness than their non-STEM counterparts. However, U.S. businesses frequently voice concerns over the availability and supply of STEM workers. Key points from the Department of Commerce include the following:

- In 2010, there were 7.6 million STEM workers in the United States, representing one in 18 workers.
- STEM occupations are projected to grow by 17 percent from 2008 to 2018, compared to 9.8 percent growth for non-STEM occupations.
- STEM workers command 26 percent higher wages than their non-STEM counterparts. More than two-thirds of STEM workers have at least a college degree, as compared to less than one-third of non-STEM workers.
- STEM degree holders enjoy higher earnings regardless of whether they work in STEM or non-STEM occupations.

**B. Description of Enhanced Offerings to Meet Need**

The Montgomery County Governor's STEM Academy will offer a program of study designed to expand options for students to acquire skills in science, technology, engineering, and mathematics that are related to advanced manufacturing. The program will combine academic coursework with a challenging and focused school environment to prepare students for 21st century careers. Students will gain the knowledge and skills they need to succeed in the technologically-rich workplace by learning how to work in teams, communicate effectively, and apply the principles and skill sets found in STEM fields. A FIRST Robotics design and build team project will be the co-curricular component for all pathways. This project will be scheduled as an after-school course to allow students from all pathways to participate.

Montgomery County Public Schools proposes to create the Governor's STEM Academy by building on the success of its current FIRST Robotics collaboration. In 1999, MCPS began a partnership with the Virginia Tech Mechanical Engineering Department and School of Education to institute a FIRST Robotics program. This partnership has proven to be resilient and effective. The project was instituted to promote STEM literacy among high school students and, unlike most FIRST Robotics programs, is built around a series of yearlong general elective courses, taught by teachers from CTE, mathematics, and science in an after-school setting. This program is supported by Virginia Tech mechanical engineering students and professors. High school students achieve a level of familiarity and literacy in engineering and other STEM topics while university students apply their engineering skills as mentors.

To build on the success of this existing program, MCPS proposes to utilize the FIRST Robotics Team project as the focal point and co-curricular project for the proposed Governor's STEM Academy. The FIRST Robotics Team project will integrate the multiple CTE and academic programs that are represented by the skill sets required to design, build, program, and operate the team robot. This will improve cross-curricular instruction and substantially expand students' understanding of STEM in the manufacturing world.

The Academy will offer three career clusters and six career pathways, all of which will have required dual enrolled courses. Each pathway will fully integrate academic instruction in mathematics and science with each CTE completer sequence. All pathways are directly related to the co-curricular FIRST Robotics project and to the skills found in advanced manufacturing. The Engineering and Technology pathway will include Project Lead the Way pre-engineering

courses and these courses will be recommended options for the Manufacturing Production and Processing pathway. Proposed new courses in Robotics Design, Technology Transfer, and Principles of Technology will be added over time to expand the capacity of the Academy in areas related to Engineering and Manufacturing Production Process Development. See page 11 for additional information regarding course offerings.

The pathways will have clear postsecondary objectives laid out through articulation with New River Community College, Radford University, and Virginia Tech. Every pathway in the Academy will culminate in a program of study at one of these three institutions. Whenever possible, both academic and CTE courses will be offered as dual enrolled courses through New River Community College or through the network of Project Lead the Way colleges *(see Appendix D Dual Enrollment Agreement).*

This program will provide awareness and opportunity for students and will increase the number of well-trained workers in areas that have been designated as high-need and high-tech in business and industry. Offering parallel pathways with multiple post-graduation objectives will help students choose the best path before graduation.

### C. Fiscal Agent

Montgomery County Public Schools will act as the fiscal agent for the MCPS Governor's STEM Academy. All financial records will be maintained in compliance with federal, state, and local regulations.

## II. PARTNERSHIP CAPACITY

### A. Planning Committee

The MCPS Governor's STEM Academy Planning Committee will consist of representatives from Montgomery County Public Schools, New River Community College, Virginia Tech, New River Valley/Mount Rogers Workforce Investment Board, the Montgomery County Office of Economic Development, and local businesses and industry. The Planning Committee will oversee the design, implementation, and evaluation of all initiatives. The MCPS Supervisor of Career and Technical Education and the Supervisor of Science Education will be responsible for the facilitation, coordination, and/or implementation of the Planning Committee recommendations.

The MCPS Governor's STEM Academy has formed strategic partnerships with local businesses, institutions of higher education, and work force development agencies to ensure that students are prepared to meet the future work force demands of STEM careers. These partners will support the goals of the MCPS Governor's STEM Academy and provide STEM resources and opportunities for students enrolled in the program. All partners will be members of the Planning Committee *(Appendix E Planning Committee Members).*

**B. Advisory Committee**

Advisory Committee members will consist of the MCPS Superintendent, Director of Secondary Education, Supervisor of Career and Technical Education, Supervisor of Science Education, and Supervisor of Mathematics Education *(see Appendix F Advisory Committee Members).*

**C. MOA / Partnership Agreement**

The Memorandum of Agreement/Partnership Agreement will be signed by all current and future partners and will outline ways in which community resources will contribute to the MCPS Governor's STEM Academy in order to broaden the scope of educational experiences. The agreement will outline the roles and responsibilities of each partner *(see Appendix G Memorandum of Agreement/Partnership Agreement).*

**D. Statement of Assurances**

The MCPS Governor's STEM Academy Planning Committee has reviewed provisions of the *Administrative Procedure Guide for the Establishment of Governor's STEM Academies* and agrees to follow the guidelines set forth in the document *(see Appendix H Statement of Assurances).*

## III. PROGRAM DESCRIPTION

### A. Program Goals

The overall purpose of the Montgomery County Governor's STEM Academy is to promote student achievement and interest in STEM career fields and to prepare students for global competitiveness in high-skill, high-wage, and high-demand STEM careers.

The MCPS Governor's STEM Academy will strive to accomplish the following goals:

- Create visibility at the secondary level for STEM occupations.
- Highlight local STEM employment opportunities.

- Increase the number of students who identify STEM areas as viable career paths.
- Improve the number of students transitioning to STEM employment or postsecondary training and education.
- Increase the number of students completing a credentialing test and earning an advanced studies diploma.
- Enhance the depth of instruction by fully integrating CTE and academic courses with a focus on STEM skills.
- Target students who are identified as underserved by various measures, including gender, ethnicity, economic background, and academic goals.

Each CTE course in the Academy will integrate a competency-based workplace readiness skills curriculum. The curriculum includes; personal qualities and people skills, professional knowledge and skills, and technology knowledge and skills. Each competency is defined by Virginia's Educational Resource System Online and is applied within each course to match the relevant career connections. Additionally, each student will be assessed by Virginia's Workplace Readiness Skills Assessment.

**B. Program Objectives and Performance Measures**

The following annual performance measures have been established by the MCPS Governor's STEM Academy's Planning Committee:

- To improve academic achievement by increasing the number of students completing a credentialing test and earning an advanced studies diploma from 29.58 percent to 29.73 percent in SY 2013-14 to SY 2014-15.
- To increase the number of students completing dual enrolled courses in engineering, manufacturing, and information technology by .5 percent from SY 2013-14 to SY 2014-15.
- To increase the number of students participating in a community-based workplace experience by 1 percent annually by working with Academy partners.
- To increase the on-time graduation rate by .5 percent from 95.28 percent in SY 2013-14, to 95.76 percent in SY 2014-15 for students in CTE completer sequences from the current.
- To reduce the dropout rate for Academy students by .1 percent annually.

- To increase the enrollment of female students in CTE courses by .5 percent annually from 32.03 percent to 32.19 percent.
- To increase the number of students successfully completing a college and workplace ready curriculum in high school as evidenced by increasing the CTE transition rate to postsecondary education, military, and employment (or combination thereof) by .5 percent. We will expand the number of students transitioning from high school to these postsecondary placements from the current 96.06 percent to 96.54 percent.
- To increase by 1 percent annually the number of students earning industry certifications from the current 57.22 percent to 58.22 percent.
- To develop a measure for Academy students requiring remediation in postsecondary education in collaboration with the Academy's higher education partners.

**C. Description and Program/School Population Profile**

Montgomery County Public Schools serves 9,530 students, including 2,937 high school students attending four high schools: Auburn, with 377 students; Blacksburg, with 1,150 students; Christiansburg, with 1,104 students; and Eastern Montgomery, with 306 students.

Presently, MCPS students can select several courses related to advanced manufacturing, but these courses are not linked together in an Academy model that will allow students to connect their learning to the wide range of employment options in our region. Additionally, we offer a Robotics I course as a general elective in which students build a robot to compete in the FIRST Robotics tournament. The proposed STEM Academy will move these disconnected courses into a career-oriented model that connects high school coursework with postsecondary plans.

The existing FIRST Robotics course is offered as an after-school general elective. This model has proven to be successful over time for the MCPS Robotics program. It offers a number of advantages including flexibility for students' schedules, the ability to share equipment and technology resources, and the opportunity for students from multiple schools to work together on the robotics competition. This proposal will expand the experience beyond extra-curricular into a co-curricular challenge embraced by a wider range of students.

The Academy, housed at Christiansburg High School, will enable students to acquire skill sets in Drafting, Pre-Engineering, Precision Machining, Welding, Information Technology, Computer Programming, and Network Systems during the school day in CTE and academic programs. These students will then have the opportunity to collaboratively apply those skills in a

new course, *Principles of Robotic Design,* which will serve as a co-curricular project for the STEM Academy. The FIRST Robotics competition will continue to provide a structure of deadlines, budget, and other parameters that simulate an advanced manufacturing workplace environment. While all students will benefit from assisting in the design and development of the competitive robot, only those willing to continue the work in the after-school hours will comprise the team destined to participate in the tournament.

In addition to the Robotics course, Montgomery County Governor's STEM Academy students will participate in various school organizations that will provide educational and leadership development activities. Students may participate in SkillsUSA (Trade and Industrial Education student organization), TSA (Technology Student Association) and STEM clubs. Establishing the Governor's STEM Academy will allow for increased student interest and the opportunity to increase participation in STEM-related student organizations.

Students may enroll in the STEM Academy as early as ninth grade, but may also enter at any point where they are able to take a completer sequence of courses and participate in the co-curricular experience. The Academic and Career Plan (ACP) will determine what courses a student must complete in order to graduate. Students will complete their academic courses according to their ACP. Some will be on track for an Advanced Studies Diploma while others will be on a Standard diploma track. CTE course sequences are defined by grade level in the chart on page 13.

**D. Governor's Exemplary Standards Award Details**

The Academy will be committed to promoting high academic standards and improving other measures of program quality, while strengthening business and community partnerships and aligning with postsecondary education and industry needs. The MCPS Governor's STEM Academy will use the Governor's Exemplary Standards Award to evaluate the programs, facilities, and instruction in the Academy with the objective of documenting every standard at the level of one or two to ensure excellence *(see Appendix I Exemplary Standards Award Checklist).*

**E. Sequence of Proposed Program and Course Descriptions**

**E.1 Career Pathways**

With assistance from counselors, career coaches, and teachers, students will choose a plan of study that correlates with a career cluster, career pathway, and one or more CTE

course sequences based on interests and abilities. Upon entering a specific Academy pathway, each student will commit to completing the plan of study and to participating in the FIRST Robotics Design and Build Team.

Students will choose a specific plan of study within the Career Clusters of STEM, Manufacturing, and Information Technology. The courses that students commit to in their plan of study will equip them with skills needed for success in their chosen careers. MCPS is working to expand options within the plans of study that will have dual enrolled components with New River Community College and in some cases, direct articulation with Virginia Tech and Radford University. The three Clusters and associated pathways are shown in the chart below:

| **STEM** | **Manufacturing** | **Information Technology** |
|---|---|---|
| Engineering and Technology | Manufacturing Production and Process Development | Programming and Software Development |
| | Production | Information Support and Services |
| | | Network Systems |

There will be a strong emphasis on the Career Pathways of Engineering and Technology, Manufacturing Production Process Development, Programming and Software Development, Information Support and Services, and Network Systems. Students may complete the STEM Academy by taking a sequence of courses at Christiansburg High.

Some of the Academy courses will be delivered at the division's other three high school campuses as well. Students who attend the smaller high schools will be eligible to continue a chosen program of study at Christiansburg High School with transportation provided by MCPS. During their junior or senior year, Academy students will have the opportunity to apply their knowledge of STEM, as well as 21st century skills, in a real-world work experience by participating in job shadowing, internships, and/or cooperative experiences related to their chosen career. CTE courses available through the Academy are listed in the following table:

| ACADEMY COURSES BY PATHWAY AND GRADE | | | | |
|---|---|---|---|---|
| **Pathway** | **9th Grade** | **10th Grade** | **11th Grade** | **12th Grade** |
| **Engineering and Technology** | 8439 Introduction to Engineering Design, DE | 8441 Principles of Engineering, DE | 8442 Computer Integrated Manufacturing, DE | 8430 Civil Engineering and Architecture |
| **Engineering And Technology** | 8425 Manufacturing Systems I | 8435 Technical Drawing and Design | 8436 Engineering Drawing and Design, DE | 8438 Advanced Drawing and Design, DE |
| **Manufacturing Production Process Development** | 8433 Materials and Processes | 8425 Manufacturing Systems I | 8439 Precision Machining, I DE | 8540 Precision Machining II, DE |
| **Production** | 8433 Materials and Processes | 8425 Manufacturing Systems I | 89190 Welding I, DE | 80191 Welding II, DE |
| **Programming and Software Development** | 6612 Computer Information Systems, DE | 6613 Advanced Computer Information Systems | 6640 Programming, DE | 6641 Advanced Programming, DE |
| **Information Support Services** | 8621 Computer Maintenance Advanced | 8622 Computer Systems Technology I | 8623 Computer Systems Technology II | 8624 Computer Systems Technology III |
| **Network Systems** | 6612 Computer Information Systems, DE | 6613 Advanced Computer Information Systems | 6650 Computer Network Software Operations I | 6651 Computer Network Software Operations II |
| **All Pathways-New Courses** | 8403 Technology Foundations | 8405 Technology Transfer | 9811 Principles of Technology I | 9812 Principles of Technology II |
| **All Pathways-New Courses** | 8421 Technology of Robotics Design | | | |

DE=Dual Enrollment Course

See *Appendix J Course Descriptions* for additional course information.

The MCPS Governor's STEM Academy is designed to give high school students the opportunity to explore several career pathways while incorporating Virginia's Workplace Readiness Skills for the Commonwealth. These career pathways will prepare students for programs leading to bachelor's degrees, two-year associate degrees, VCCS diplomas and certificates, apprenticeships, and employment. The MCPS Governor's STEM Academy will accept approximately 150 students for the initial school year, SY 2014-2015.

Creating a Governor's STEM Academy in MCPS will raise student aspirations and attract more students to postsecondary education. The program will provide awareness and opportunity for students and will increase the number of well-trained workers in areas that have been designated as high need and high tech in business and industry. Offering parallel pathways with multiple post-graduation objectives will help students choose the best path before graduation by allowing them to move between pathways as they learn more about the academic and workplace requirements for each pathway. *(See Appendix K Academy Course Framework for pathways.)*

Upon completion of the Academy, students will have the skills they need to continue postsecondary opportunities with local college and university programs to include New River Community College, Virginia Western Community College, Virginia Tech's College of Engineering, and Radford University's College of Science and Technology. While enrolled in the Academy, students will have the opportunity to:

- earn any of the following diploma seals upon graduation: Governor's Seal; Board of Education's Advanced Mathematics & Technology Seal; and the Board of Education's Career and Technical Education Seal
- earn a minimum of nine postsecondary credits and/or earn an industrial certification specific to the chosen career pathway
- participate in internships with research labs, businesses, colleges, and universities
- engage with an integrated curriculum that helps students see connections among mathematics, science, and technology
- be part of a school culture designed to develop workplace readiness skills to meet industry needs
- learn about advanced manufacturing careers through mentors, CTE student organizations, worksite visits, guest speakers, internships, and job shadowing experiences
- participate in school and community STEM showcase activities

**E.2 Requirements for Program Completion**

Students who are selected for the Academy will be required to meet the following criteria to complete the program successfully:

- Maintain a 3.0 grade-point average.
- Complete an appropriate STEM Plan of Study designed by student, parent, counselor and career coach.
- Complete a STEM work-based internship (minimum of 15 hours).
- Successfully complete all courses within a specific Academy pathway for high school credit, including a CTE completer sequence of courses.
- Earn an industry certification and/or at least nine transferrable college credits.

**F. Length of Program and Daily Schedule**

The MCPS Governor's STEM Academy will be a full day academic year program on a 4X4 block schedule. Classes will meet Monday through Friday on the regular Christiansburg High School schedule. The Robotics co-curricular team will meet as a class after school in a zero block on Monday, Tuesday and Wednesday *(see Appendix L STEM Academy Bell Schedule).*

**G. Fiscal Agent Assurance of Funding and Facilities**

As the fiscal agent for this project, MCPS has adequate operating funds and facilities available to support the needs of this proposed Governor's STEM Academy. Materials and equipment for the Academy will follow state purchasing guidelines and may be obtained through donations from local industry and higher education partners, local school division funds, state equipment funds, and the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV). Equipment purchased with state or federal funds will be selected from the state-approved equipment list for career and technical education programs. Equipment purchased through the Perkins grant will meet all applicable grant regulations.

**H. Materials and Equipment**

Materials and equipment for the Montgomery County Governor’s STEM Academy will follow state purchasing guidelines and may be obtained through donations from local industry and higher education partners, local school division funds, state equipment funds, and the Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV).

### I. Internal Evaluation

The basis for evaluating the STEM Academy will be the Virginia Governor's CTE Exemplary Standards. The program objective will be to achieve a level of one or two on the standards checklist to ensure excellence *(see Appendix I Exemplary Standards Checklist).*

In order to ensure continuing relevance to the local job market, the Planning Committee will assist in the evaluation of the MCPS Governor's STEM Academy by providing feedback and data. The committee will ensure that the following are included in annual evaluations of the Academy:

- A review of the Academy's policies, procedures, and outcomes
- Consideration of feedback from all stakeholders
- Collection and reporting of data to the Department of Education

## IV. ADMINISTRATIVE PROCEDURES

### A. Partnerships

The MCPS supervisor of Career and Technical Education will serve as the director of the Governor's STEM Academy and will facilitate and/or coordinate its design, implementation, evaluation, and reporting. Responsibilities of the MCPS Governor's STEM Academy director will include, but are not limited to, the following:

- Facilitate the Governor's STEM Academy Planning and Advisory Committees regarding the design and implementation process.
- Serve as the primary contact to the Virginia Department of Education (VDOE).
- Develop Governor's STEM Academy marketing materials, Web site, and forms.
- Assist with scheduling and coordination of events with sponsoring partners.
- Coordinate the Academy's application and selection process.
- Serve as liaison with partnering colleges and universities in the oversight of dual enrollment courses.
- Facilitate business and organizational participation and support of the STEM Academy.
- Prepare and monitor the budget for the MCPS Governor's STEM Academy.
- Manage program data and supply all reports and information requested by the VDOE.
- Coordinate MCPS Governor's STEM Academy staff development activities.

## B. Student Recruitment, Selection Criteria, and Admissions

Student recruitment will be the responsibility of MCPS high school staffs, the Supervisor of Career and Technical Education, and members of the Planning and Advisory Committees. Beginning in middle school, all prospective Academy students will have the opportunity to participate in pre-Academy programs including site tours and open houses that will be coordinated by the MCPS supervisor of Career and Technical Education. Students will complete interest inventories in middle school and throughout high school under the guidance of school counselors, career coaches, and classroom instructors, who will monitor individual career pathways identified by the students.

During high school, students will work with school counselors to complete career assessments and create academic and career plans outlining intended courses of study. These career plans will be reviewed annually prior to course registration and adjusted as needed to meet the needs and interests of each student. Postsecondary pathways will also be reviewed and discussed. School admission requirements, industry certifications and credentialing options, career studies, associate or technical college degrees, and four-year college degree programs will also be reviewed with students and parents *(see Appendix M Plans of Study).*

Student participants in the MCPS Governor's STEM Academy will be selected based on academic history, career interests, and recommendations from counselors, career coaches, and teachers. Selection criteria will include the following:

- STEM career interest and aspiration
- Selection of one CTE completer sequence in Engineering and Technology, Manufacturing Production Process Development, Production, Programming and Software Development, Information Support and Services, or Network Systems through guidance counseling and Virginia Wizard interest and ability inventories
- Participation in co-curricular robotics course
- 3.0 or higher GPA

The selection process will begin in seventh grade through the Academic and Career Plan process, for which MCPS is creating Web-based access to increase student accessibility and use. A Web-based information and action portal will be developed. While rigorous instruction will be provided, it is not the intention of MCPS to use the Academy as a gatekeeper for entering the STEM fields represented in the Academy. The Academy will evaluate relevance to

each student's interest and abilities and nurture relationships with local business, industry, and higher education to fully develop student skill sets that align with postsecondary educational opportunities and employment in the designated STEM fields.

**C. Student Code of Conduct**

MCPS Governor's STEM Academy student discipline, attendance, and safety policies will adhere to the policies and practice of Montgomery County Public Schools and/or the provider of services (e.g., colleges/universities, business partners).

**D. Transportation**

School bus transportation will be provided for all students who attend MCPS and are accepted into the MCPS Governor's STEM Academy.

**E. Staff Recruitment**

Staff recruitment will be a function of the MCPS Human Resources Department, assisted by the Supervisor of Career and Technical Education and the Director of Secondary Education. Teacher candidates will be actively pursued who have industry-specific education along with training and experience, including industry certification. All teachers will be highly qualified and fully licensed to teach in their subject area.

**F. Staff Development**

All teachers will be given the opportunity to participate in engaging STEM professional development activities that will assist them in providing high-quality STEM instruction to prepare students for Academy coursework. Teachers will participate in summer institutes, conferences, workshops, and on-site professional development opportunities to expand their use of project-based and experiential learning strategies.

STEM workshops will build on MCPS's recently completed CTE/Mathematics and Science curricular integration at the middle school level. The successful VDOE grant-funded projects, *Inquiry by Engineering Design (IBED)* and *Integrated STEM for Middle Schools* created a sustainable, replicable model for integrating STEM learning activities into the middle school curriculum through collaboration among science, mathematics, and CTE teachers. IBED enhanced teachers' content knowledge, understanding, and application of the engineering design process by providing middle school students with relevant, problem-based learning opportunities in an integrative STEM context. The quality of the professional development is represented through http://ibed.weebly.com/.

Teachers will be required to integrate the content and strategies gained through professional development activities into classroom modules and lessons. Opportunities for learning during the school year will be provided through observations of classroom instruction. Follow-up activities and resources will be provided and communicated with teachers. Training will support research-based instructional strategies for STEM curriculum. Where applicable, business partners will assist in providing teacher training. Teachers will collaborate with postsecondary and business partners to create real-world STEM opportunities where students can apply what they have learned.

**G. Staff Evaluation**

Supervision and evaluation of MCPS Governor's STEM Academy instructional faculty will be conducted according to the policies and procedures set by the MCPS School Board. Personnel will be hired who meet Virginia teacher licensure requirements and/or postsecondary faculty qualifications. Where applicable, teachers must have industry-specific education with training and experience, including industry certification. Staff will be evaluated according to MCPS polices using the teacher performance assessment tool established by the school division.

**H. Parent, Student, and Community Involvement**

Parents, students, and the community will be actively involved in Academy program planning. Student and parent informational workshops, parent-teacher conferences, college visits, and business partnerships will be among the activities used to encourage student, parent, and community involvement with Academy initiatives. Virginia Tech, New River Community College, parents, and business partners will support the FIRST Robotics competition course by serving as coaches and mentors and by providing material and financial support.

Information, including Academy Pathways, will be disseminated to students and parents beginning at the middle school level as an integral part of the Academic and Career Plan initiative. Career assessments will be used in the ACP process for all middle school students. Middle school exploratory programs, particularly the Technology Education program, will also assist in preparing and identifying students for the Academy.

**I. Insurance, Budget, and other Fiscal Information**

Montgomery County Public Schools' liability insurance policy will cover all Academy activities, students, and personnel *(see Appendix N Certificate of Insurance).*

MCPS will serve as the fiscal agent for this project. Funding for this program will be secured through MCPS and supplemented with grant funds from the VDOE. Comprehensive budget details can be found in the appendix *(see Appendix O Budget).*

The Academy budget will support staffing, training, professional development, student activities and state of the art STEM equipment including the following items:

- $227,190 will be provided by MCPS to support staffing and some equipment.
- $27,398 in Perkins funds will be used to purchase equipment and to support training for an additional PLTW Teacher and professional development for Academy teachers.
- $5,000 in Governor's STEM Grant funds will be used for program awareness and student recruitment activities and to supplement teacher in-service and professional development.
- Grants and donations from project partners will be sought to supplement the program.

# APPENDICES

# APPENDIX A

**Employment by Sector, Montgomery County, VA (3rd Qtr. 2012)**

| | | |
|---|---|---|
| Agriculture Forestry Fishing and Hunting | 85 | 0.2% |
| Mining Quarrying and Oil and Gas Extraction | N.D. | N.D. |
| Utilities | N.D. | N.D. |
| Construction | 1,175 | 3.0% |
| Manufacturing | 4,792 | 12.1% |
| Wholesale Trade | 515 | 1.3% |
| Retail Trade | 4,824 | 12.2% |
| Transportation and Warehousing | 283 | 0.7% |
| Information | 313 | 0.8% |
| Finance and Insurance | 528 | 1.3% |
| Real Estate and Rental and Leasing | 932 | 2.4% |
| Professional Scientific and Technical Services | 2,137 | 5.4% |
| Management of Companies and Enterprises | 304 | 0.8% |
| Administrative and Support and Waste Management | 1,579 | 4.0% |
| Educational Services | 325 | 0.8% |
| Health Care and Social Assistance | 3,783 | 9.6% |
| Arts Entertainment and Recreation | 378 | 1.0% |
| Accomodation and Food Services | 4,308 | 10.9% |
| Other Services | 938 | 2.4% |
| Total Government | 12,304 | 31.1% |
| Federal Government | 236 | 0.6% |
| State Government | 8,294 | 21.0% |
| Local Government | 3,774 | 9.5% |
| Unclassified | 0 | 0 |
| Total | 39,569 | 100.0% |

*N.D. - Not Disclosed*
**By Business Establishment*

**Major Employers**
**Manufacturing**

| *Company* | *Product/Service* | *Estimated Employment* |
|---|---|---|
| Alliant Techsystems, Inc. | Explosives | 600 - 999 |
| C & S Door Corp. | Doors & blinds | 100 - 299 |
| Cobham Sensor Systems | Circuit components | 50 - 99 |
| Comprehensive Computer Solutions | Computer solutions | 50 - 99 |
| Corning, Inc. | Ceramic fibers | 300 - 599 |
| Eagle Picher Industries | Automotive gaskets | 300 - 599 |
| Federal Mogul Corp. | Engine bearings | 100 - 299 |
| LUNA Inovations | New-generation products | 100 - 299 |
| Moog Components Group | Security products | 600 - 999 |

| | | |
|---|---|---|
| Rowe Industries Inc. | Furniture | 600 - 999 |
| TECHLAB, Inc. | Diagnostics | 50 - 99 |
| United Pet Group | Animal food | 100 - 299 |

**NonManufacturing**

| *Company* | *Product/Service* | *Estimated Employment* |
|---|---|---|
| Carillon New River Valley Medical Ctr | Health care | 600 - 999 |
| EchoStar Communications | Satellite TV call center | 600 - 999 |
| Inorganic Ventures, Inc | Chemical Laboratory | 50 - 99 |
| Intrexon Corporation | Biotechnology R&D | 50 - 99 |
| Montgomery Regional Hospital | Health care | 300 - 599 |
| Rackspace, Inc. | Email Hosting Services | 50 - 99 |
| Virginia Polytechnic Institute and State University | Higher education | 10,000+ |
| VTLS, Inc. | Library solutions | 50 - 99 |

**Other Assets**

Virginia Tech Corporate Research Center-

- Received the **"2010 Outstanding Research/Science Park Award"** (2010)
- "Received **Excellence in Technology-led Economic Development Award"** granted by the Economic Development Administration of the U.S. Department of Commerce (2004).
- Named **"Best Practice in Technology Transfer and Research Centers"** by National Council for Urban Economic Development (1997).

VT Knowledge Works

- Named **"Most Promising New Incubator"** at the 2008 Science Alliance Conference on Best Practices in Science-Based Incubation.

Blacksburg - Christiansburg-Radford Metro

- Ranked the 8th **"Best Emerging Metropolitan Statistical Area"** (2004).
- Listed as one of 74 **"Five-Star Knowledge Worker Metros"** (2005).
- Designated a **"5-Star Business Opportunity Metro"** (2006).
- Named 5th **"Best Small City for Jobs"** (2012).
- named 4th **"Top Metro by Number of Projects"** (2011). Blacksburg Metro was ranked 10th 2010, 8th in 2008 and 5th in 2005.
- Ranked the No. 2 "**American City Adding Jobs**" by 24/7 Wall St (2012).

Roanoke- Blacksburg Technology Council

APPENDIX B

The table below shows the distribution of industries in New River Community College, Virginia for the 3rd quarter, 2012.

| Rank | Industry Sector | Establishments | Employees |
|---|---|---|---|
| 1 | Total, all industries | 4,017 | 66,329 |
| 2 | Education Services | 52 | 14,017 |
| 3 | Manufacturing (31-33) | 160 | 11,289 |
| 4 | Retail Trade (44 & 45) | 542 | 8,059 |
| 5 | Health Care and Social Assistance | 643 | 7,138 |
| 6 | Accommodation and Food Services | 350 | 6,744 |
| 7 | Professional Scientific & Technical Svc | 424 | 2,923 |
| 8 | Admin., Support, Waste Mgmt, Remediation | 164 | 2,618 |
| 9 | Construction | 399 | 2,327 |
| 10 | Public Administration | 144 | 2,162 |

Source: Labor Market Statistics, Covered Employment and Wages Program

The table below shows the industries with the highest job openings advertised online in New River Community College, Virginia on April 14, 2013 (Jobs De-duplication Level 1).
To sort on any column, click a column title.

| Rank | Industry | Job Openings |
|---|---|---|
| 1 | Educational Services | 196 |
| 2 | Health Care and Social Assistance | 105 |
| 3 | Retail Trade | 99 |
| 4 | Public Administration | 71 |
| 5 | Manufacturing | 63 |
| 6 | Administrative and Support and Waste Manageme | 47 |
| 7 | Professional, Scientific, and Technical Servi | 44 |
| 8 | Accommodation and Food Services | 33 |
| 9 | Information | 28 |
| 10 | Wholesale Trade | 11 |

Virginia Employment Commission
https://www.vawc.virginia.gov/vosnet/lmi/area/areasummary.aspx?enc=SgfjA5gOXyjl8J88h1RJLVbNcg+NUlb3ghzfQ2KyaB6PJuB23WgXMUaAp8hcKF+7

APPENDIX C
Jobs by Occupation Group

The table below shows the distribution of job openings advertised online in New River Community College, Virginia on April 14, 2013 by occupation group (Jobs De-duplication Level 1).
To sort on any column, click a column title.

| Rank | Occupation Group | Job Openings |
|---|---|---|
| 1 | Management Occupations | 219 |
| 2 | Healthcare Practitioners and Technical Occupations | 218 |
| 3 | Sales and Related Occupations | 163 |
| 4 | Food Preparation and Serving Related Occupations | 160 |
| 5 | Office and Administrative Support Occupations | 119 |
| 6 | Education, Training, and Library Occupations | 97 |
| 7 | Computer and Mathematical Occupations | 95 |
| 8 | Transportation and Material Moving Occupations | 85 |
| 9 | Production Occupations | 84 |
| 10 | Architecture and Engineering Occupations | 64 |
| 11 | Healthcare Support Occupations | 55 |
| 12 | Arts, Design, Entertainment, Sports, and Media Occ | 47 |
| 13 | Installation, Maintenance, and Repair Occupations | 44 |
| 14 | Construction and Extraction Occupations | 37 |
| 15 | Business and Financial Operations Occupations | 32 |
| 16 | Personal Care and Service Occupations | 28 |
| 17 | Building & Grounds Cleaning & Maintenance Occup. | 27 |
| 18 | Life, Physical, and Social Science Occupations | 26 |
| 19 | Community and Social Services Occupations | 21 |
| 20 | Protective Service Occupations | 19 |
| 21 | Military Specific Occupations | 6 |
| 22 | Legal Occupations | 4 |
| 23 | Farming, Fishing, and Forestry Occupations | 1 |

Job Source: Online advertised jobs data

Virginia Employment Commission
https://www.vawc.virginia.gov/vosnet/lmi/area/areasummary.aspx?enc=SgfjA5gOXyjl8J88h1RJLVbNcg+NUIb3ghzfQ2KyaB6PJuB23WgXMUaAp8hcKF+7

# APPENDIX D

## Dual Enrollment Agreement

## Montgomery County Public Schools and New River Community College

**Dual Enrollment Contract**

**Between**

**New River Community College**
**and**
**Montgomery County Public Schools**

The purpose of this agreement is to set out the terms and conditions upon which courses will be offered under the "Virginia Plan for Dual Enrollment Between Virginia Public Schools and Community Colleges" established by the Secretary of Education, the VCCS Chancellor, and the Superintendent of Public Instruction in January 2005. The purpose of this offering is to allow high school students to take college-level courses and receive both college credit and high school credit towards graduation.

Each party does hereby agree to the following:

1. Under this agreement, New River Community College, (herein after "the College"), will make available college-level courses to students of the Montgomery County Public School System for the 2012-2013 academic year.

   The courses to be offered will be established by mutual agreement of both parties for the fall and spring semesters. A list of courses can be found as Attachment 1, and are hereby incorporated into this agreement.

   The responsibilities of the parties pursuant to this agreement are conditional upon student registration for the course(s) being completed and subject to adequate student enrollment as determined by the college. The College and Montgomery County Public Schools reserve the right to cancel any class sections or add sections, no later than the census date for the class as determined by the college.

2. Tuition & Fees (See attached letter for explanation—Attachment 2.)

   Pursuant to the Virginia Plan for Dual Enrollment, schools and colleges are encouraged to provide high school students the opportunity for dual enrollment at no cost to them or their families. If tuition will be charged, then the School will pay on behalf of the student or students, or the student will pay the College, the mandatory tuition and any fees established by the State Board for Community Colleges at the rate then in effect at the time the classes begin. Where the School agrees to pay the tuition and fees, the College will bill the School on a semester basis. If the parties agree the students are responsible for such payments, the College will bill the students directly for them.

3. Textbooks

   The College reserves the right to determine the textbooks used in dual enrollment courses. The provision of all dual enrollment course textbooks is the responsibility of the Montgomery County Public Schools.

## APPENDIX E

## MCPS Governor's STEM Academy Planning Committee Memnbers

| Name | Title | Organization |
|---|---|---|
| Ben Knapp | Director, Institute for Creativity, Arts, and Technology | Virginia Tech |
| Brian Hamilton | Director | Montgomery County Department of Economic Development |
| Dan Lookadoo | Dean, Business & Technologies | New River Community College |
| Debra Kennedy | Career Pathways Coordinator | New River Community College |
| George Wilkins | General Manager | Jeld-Wen Interior Doors |
| Henry Bass | President | Automation Creations, Inc. |
| J. D. Price | Vice-President | OWPR Architects and Engineers |
| Jeff Roberts | Production Manager | Moog Components Group |
| John Wells | Associate Professor, Technology Education | Virginia Tech |
| Liesl Baum | Research Associate | ICAT |
| Linda Vick | Program and Career Advisor | Virginia Tech Mechanical Engineering |
| Marty Holliday | Deputy Director | New River Valley Competitiveness Center |
| Paul Fleming | Facilities Director, VTCRC | Virginia Tech Corporate Reesearch Center |
| Peter Anderson | Grant Manager, Business & Technologies | New River Community College |
| Susan Magliaro | Director, VT-STEM | Virginia Tech |
| Brenda Blackburn | Superintendent | Montgomery County Public Schools |
| Nelson Simpkins | Director of Secondary Education | Montgomery County Public Schools |
| Rick Weaver | Supervisor of Career and Technical Education | Montgomery County Public Schools |
| Patricia Gaudreau | Supervisor of Science Education | Montgomery County Public Schools |
| Jonathan Shultz | Supervisor of Math Education | Montgomery County Public Schools |

# APPENDIX F

## Advisory Committee Members

| | | |
|---|---|---|
| **Brenda Blackburn** | **Superintendent** | **Montgomery County Public Schools** |
| **Nelson Simpkins** | **Director of Secondary Education** | **Montgomery County Public Schools** |
| **Rick Weaver** | **Supervisor of Career and Technical Education** | **Montgomery County Public Schools** |
| **Patricia Gaudreau** | **Supervisor of Science Education** | **Montgomery County Public Schools** |
| **Jonathan Shultz** | **Supervisor of Math Education** | **Montgomery County Public Schools** |
| **Kevin Siers** | **Principal** | **Christiansburg High School** |

# APPENDIX G

# MEMORANDUMS OF UNDERSTANDING / PARTNERSHIP AGREEMENTS

| APPENDIX G | | | |
|---|---|---|---|
| MCPS STEM Academy Partnerships | | | |
| **Name** | **Title** | **Organization** | **Partnership Agreement Attached** |
| Ben Knapp | Director, Institute for Creativity, Arts, and Technology | Virginia Tech | X |
| Brian Hamilton | Director | Montgomery County Department of Economic Development | X |
| Dan Lookadoo | Dean, Business & Technologies | New River Community College | X |
| Debra Kennedy | Career Pathways Coordinator | New River Community College | X |
| George Wilkins | General Manager | Jeld-Wen Interior Doors | X |
| Henry Bass | President | Automation Creations, Inc. | X |
| J. D. Price | Vice-President | OWPR Architects and Engineers | X |
| Jeff Roberts | Production Manager | Moog Components Group | X |
| John Wells | Associate Professor, Technology Education | Virginia Tech | X |
| Liesl Baum | Research Associate, Institute for Creativity, Arts, and Technology | Virginia Tech | X |
| Linda Vick | Program and Career Advisor | VirginiaT ech Mechanical Engineering | X |
| Marty Holliday | Deputy Director | NRV Competitiveness Center | X |
| Paul Fleming | Facilities Director, VTCRC | VT Corporate Research Center | X |
| Peter Anderson | Grant Manager, Business & Technologies | New River Community College | X |
| Susan Magliaro | Director, VT-STEM | Virginia Tech | X |

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Virginia Tech

**Signature:** [illegible] Ben Knapp

**Title:** Director of ICAT + Professor, Computer Science

**Date:** 19 February, 2013

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Montgomery County, VA Economic Development

**Signature:** Brian Hamilton

**Title:** Director

**Date:** 07/19/2013

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** New River Community College

**Signature:** (Dan A. Lodge)

**Title:** Dean Business and Technologies

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** New River Community College

**Signature:** Deborah D Kennedy

**Title:** Enrollment Management & Career Pathways Coordinator

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- ✓ Identify the employment needs and opportunities in New River Valley STEM industries.
- ✓ Provide guidance in the development of curriculum and course offerings relating to STEM.
- ✓ Provide opportunities for job shadowing and internships as appropriate for students.
- ✓ Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- ✓ Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Jeld-Wen Interior Doors

**Signature:** George Wilkins

**Title:** General Manager

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM Industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** OWPR, Inc.

**Signature:** JD Price

**Title:** Vice President, OWPR

**Date:** 2-19-13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Moog Components Group

**Signature:** William J Roberts Jeff Roberts

**Title:** Production Manager

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Virginia Tech – Integrative STEM Education

**Signature:** John Wells

**Title:** Associate Professor/Program Leader

**Date:** 2-19-2013

MOU?

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** ICAT at Virginia Tech

**Signature:** Liesl Baum

**Title:** ~~[illegible]~~ Research Faculty

**Date:** 2.19.13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Virginia Tech (ME Department)

**Signature:** Linda Vick  Linda Vick

**Title:** Instructor / Academic & Career Advisor

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** New River / Mount Rogers Workforce Inv. Board

**Signature:** Marty Holliday

**Title:** Deputy Director

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** VTCRC

**Signature:** Paul Fleming

**Title:** Dir. of Facilities + Data Sys

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM Industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** New River Community College

**Signature:** Peter Anderson

**Title:** Grant Administrator

**Date:** 2/19/13

**Partnership Agreement**
**Between**
**Montgomery County Public Schools**
**And**
**Montgomery County Public Schools Governor's STEM Academy Partners**

Montgomery County Public Schools and the undersigned partner agree to work together to inspire and prepare MCPS students to pursue higher education and career opportunities in Science, Technology, Engineering, and Mathematics (STEM) fields.

STEM Academy Partners agree to:

- Identify the employment needs and opportunities in New River Valley STEM industries.
- Provide guidance in the development of curriculum and course offerings relating to STEM.
- Provide opportunities for job shadowing and internships as appropriate for students.
- Provide opportunities for site visits when possible to expose students and faculty to STEM work settings and STEM employees.
- Participate as possible in STEM activities and programs that further the goals of the STEM Academy.

MCPS Agrees to:

- Coordinate the MCPS Governor's STEM Academy.
- Designate a STEM Academy point of contact for partners.
- Provide partners with a menu of partnership activities and programs that partners may choose from to further the mission of the STEM Academy.
- Offer curricula related to engineering, technical drawing, modeling and simulation, precision machining, welding, robotics, and information technology.
- Provide a STEM Academy overview, tour and orientation to partners as needed.

**By signing this agreement, partners agree to support the measures listed above in support of the Montgomery County Public Schools Governor's STEM Academy.**

**Name of Partner Organization:** Virginia Tech VT-STEM

**Signature:** Sue Magliaro Sue Magliaro

**Title:** Director, VT-STEM

**Date:** 2/19/13

# APPENDIX H

**Governor's Science, Technology, Engineering and Mathematics (STEM) Academy**

## STATEMENT OF ASSURANCES

The authorized signature on this page certifies to the Virginia Department of Education that the authorized official assures that:

1. The planning committee has reviewed the provisions of *Administrative Procedures Guide for the Establishment of Governor's STEM Academies* outlined in the Guidance Document, and understands that an implementation proposal will need to address these criteria and/or others approved by the Virginia Board of Education.

2. The planning committee agrees to follow the guidelines set forth in the *Administrative Procedures Guide for the Establishment of Governor's STEM Academies* document.

3. If the Governor's STEM Academy will be a jointly-operated program, an ongoing governing board will be established or maintained to reflect current Board of Education regulations relative to jointly-operated schools and programs.

4. Montgomery County Public Schools will serve as the grant fiscal agent.

Certification by Authorized or Institutional Official:

The applicant certifies that to the best of his/her knowledge the information in this application is correct, that the filing of this application is duly authorized by the partners participating in this process to establish a Governor's STEM Academy, and that the applicant will comply with the statements of assurances.

Rick Weaver, Supervisor of Career and Technical Education

Rick Weaver

*Signature of Authorized Official* *Date* 4/22/2013

# APPENDIX I

## Exemplary Standards Checklist

# VIRGINIA GOVERNOR'S CAREER AND TECHNICAL EDUCATION
# EXEMPLARY STANDARDS AWARD 2011-2012

**Believing only excellent programs should be nominated for this award, each item of documentation will be rated 2 or 1.**
**2 = Excellent: component is documented completely and clearly; quality evidence is obvious**
**1 = Good: documentation is present but may not be clear or of high quality**
**0 = Evidence is missing**

***All documentation and evaluation is completed online at a site provided by the Virginia Career Education Foundation. This overview document is for planning purposes only.***

**Program:**_____

| **A. PROGRAM EXCELLENCE** | | | | | |
|---|---|---|---|---|---|
| **1. Learning goals and objectives are clear, challenging, and measurable.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***1a. Goals and objectives are clearly stated, realistic, and measurable.*** | | | | | |
| 1) Program description | | | | | |
| 2) Course syllabus | | | | | |
| 3) Goals and objectives | | | | | |
| ***1b. Goals and objectives are based on current research and successful practice.*** | | | | | |
| 4) Competencies/Framework (link to VERSO) | | | | | |
| 5) Evidence of current and future industry trends and practices in program area | | | | | |
| 6) List enhancements, supplements, and additional curriculum developed for this program (textbooks and other media) | | | | | |
| 7) Evidence of interacting with industry to ensure program reflects current trends (speakers, advisory council members input, etc.) | | | | | |
| ***1c. Goals and objectives reflect rigor and high expectations for learner achievement.*** | | | | | |
| 8) Copy of goals and objectives with rigor and high expectations highlighted | | | | | |
| ***1d. Goals and objectives are aligned with the mission and vision of the institution.*** | | | | | |
| 9) Provide vision and mission statements of division, school, and program and explain how they align | | | | | |
| ***1e. Goals and objectives emphasize critical thinking skills and problem solving.*** | | | | | |
| 10) Highlight the goals and objectives that emphasize critical thinking skills and problem solving. | | | | | |
| Standard 1 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 1: | | | | | |

| A. PROGRAM EXCELLENCE | | | | | |
|---|---|---|---|---|---|
| **2. The program content aligns with learning goals and is accurate, current, and relevant.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***2a. The program is technologically current; provides opportunities for learners to use state-of-the-art technology within their industry area; and reflects the impact of technological advances within each chosen field.*** | | | | | |
| 11) Physical Classroom/Lab Setting: Description of typical workstation, number of workstations; may include photos | | | | | |
| 12) Identify strengths, weaknesses, and plans for classroom/lab improvements | | | | | |
| 13) Provide three examples of how technology is used in the classroom | | | | | |
| ***2b. The learning environment reflects a positive climate.*** | | | | | |
| 14) Describe how program complies with safety and sanitation requirements (meets OSHA regulations if applicable) | | | | | |
| • *Classroom is inviting, well-organized, and clean (to be determined by on-site visit)* | | | | | |
| ***2c. Curriculum and instruction are culturally and ethnically sensitive, free of bias, and reflect diverse learner interests and participation.*** | | | | | |
| 15) Provide three lesson plans showing how different learning styles are addressed. Highlight examples. | | | | | |
| 16) Describe adaptive technology in use (if applicable) | | | | | |
| 17) Provide three lesson plans showing accommodations for special education population or sample IEP for this program (if applicable) | | | | | |
| ***2d. The content and instruction emphasize development and understanding of all aspects of industry.*** | | | | | |
| 18) Provide two samples of lesson plans showing emphasis on All Aspects of Industry competencies Highlight examples. | | | | | |
| Standard two Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 2: | | | | | |

| A. PROGRAM EXCELLENCE | | | | | |
|---|---|---|---|---|---|
| **3. The program is aligned with academic standards.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***3a. The program goals, content, and assessments are aligned and integrated with appropriate local, state, and national academic standards.*** | | | | | |
| 19) Curriculum alignment document (provide link to SOL correlation for this program in VERSO) | | | | | |
| 20) Provide two lesson plans that emphasize Science, Technology, Engineering, and Mathematics (STEM) competencies. Highlight | | | | | |
| 21) Provide two lesson plans that support core Virginia Standards of Learning (SOL) objectives. Highlight | | | | | |
| ***3b. The program ensures that students are prepared with academic knowledge and are ready to transition into further education and/or the workplace.*** | | | | | |
| 22) Dual enrollment agreement with community colleges/universities, if applicable | | | | | |
| 23) Evidence of career pathway for this program that aligns CTE curriculum offerings at middle school, high school, and postsecondary programs (from local plan) | | | | | |
| Standard three Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 3: | | | | | |

| A. PROGRAM EXCELLENCE | | | | | |
|---|---|---|---|---|---|
| **4. The program is aligned with industry standards and validated by Virginia business/industry representatives.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***4a. The program goals, content, and assessments are aligned and integrated with appropriate state or national occupational or industry skill standards.*** | | | | | |
| 24) Explain program alignment with national industry or skill standards | | | | | |
| ***4b. The program is validated by Virginia business/industry representatives.*** | | | | | |
| 25) Identify how local Career and Technical Education Advisory Council, Craft Committee, or other industry representatives were involved with program/curriculum/equipment implementation | | | | | |
| ***4c. The program goals, content, and assessment include Virginia's Workplace Readiness Skills.*** | | | | | |
| 26) Provide two lesson plans that include Virginia's Workplace Readiness Skills Highlight | | | | | |
| ***4d. The program is certified or recognized by industry, professional, and/or trade associations or state licensing agencies and can lead to postsecondary degrees, industry certifications, licensure, and other recognized credentials.*** | | | | | |
| 27) Describe industry credentials available to students through this program<br>28) Copy of program certification by industry, if applicable<br>Teacher's credentials:<br>29) Copy of industry certification(s) or comparable credentials<br>30) Evidence of workshops or courses completed in related field or in education in general for last three years | | | | | |
| Standard 4 Points Awarded by Evaluator:<br>Sum each column | | | | | |
| TOTAL Points Standard 4: | | | | | |

| A. PROGRAM EXCELLENCE | | | | | |
|---|---|---|---|---|---|
| **5. Collaborations with internal and external organizations and stakeholders are maintained to strengthen the quality and effectiveness of the program.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***5a. Strong, visible partnerships with measurable results are established and maintained with business, industry, and community collaborators. Various groups may become involved with the general program and curriculum planning, workplace learning experience development, and program improvement strategies.*** | | | | | |
| 31) Document a minimum of four examples of partnership involvement from the list below. Documentation may include letters of support, meeting agenda, or event summary.<br>▪ volunteers<br>▪ parents<br>▪ guest speakers<br>▪ field trips<br>▪ judges for CTSO events<br>▪ industry tours<br>▪ financial/material donations | | | | | |
| ***5b. There is evidence of support from leaders from within the organization.*** | | | | | |
| 32) Letters of support from school/division leaders | | | | | |
| 33) Awards/recognitions received from school/division | | | | | |
| ***5c. Collaboration results in articulated and well developed career pathways at the secondary and postsecondary levels.*** | | | | | |
| 34) Examples of how career pathways and dual credit opportunities are communicated to students | | | | | |
| 35) Document collaboration with school counselors/career coaches that supports student academic and career planning | | | | | |
| Standard 5 Points Awarded by Evaluator:<br>Sum each column | | | | | |
| TOTAL Points Standard 5: | | | | | |

| B. EDUCATIONAL SIGNIFICANCE | | | | | |
|---|---|---|---|---|---|
| **6. The program addresses important individual, societal, and business/industry needs.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***6a. Through approved Career and Technical Student Organization (CTSO), the program prepares learners to become productive citizens, leaders, and lifelong learners.*** | | | | | |
| 36) Complete CTSO Data CHART | | | | | |
| 37) Provide two lesson plans that demonstrate that the CTSO is co-curricular. Highlight | | | | | |
| 38) Provide two examples of CTSO recruitment activities | | | | | |
| 39) Evidence of community service projects | | | | | |
| 40) Evidence of teacher serving as a role model through participation in local, regional, state and national CTSO organizations | | | | | |
| ***6b. The program contributes to local and regional workforce development and to the community's economic growth and development.*** | | | | | |
| 41) Provide career outlook or job forecast related to this program | | | | | |
| 42) Business, trade association, or parent testimonials | | | | | |
| 43) Complete Co-op and Wage Data CHART, if applicable | | | | | |
| 44) Provide a copy of a co-op, internship or training agreement/plan, if applicable<br>45) Provide a sample or summary of employer evaluations/surveys | | | | | |
| ***6c. The program promotes equity and equal access for all learners, including members of special populations and student preparing for non- traditional careers.*** | | | | | |
| 46) Provide 1 or more examples of promotions that target nontraditional occupations/enrollment, if applicable | | | | | |
| Standard 6 Points Awarded by Evaluator:<br>Sum each column | | | | | |
| TOTAL Points Standard 6: | | | | | |

| B. EDUCATIONAL SIGNIFICANCE | | | | | |
|---|---|---|---|---|---|
| **7. The program contributes to educational excellence for all learners and leads to other positive results or outcomes.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***7a. The program contributes to whole school or systemic reform.*** | | | | | |
| 47) Describe how this program participates in school improvement | | | | | |
| ***7b. The program maintains an atmosphere of mutual respect and high expectations for all learners.*** | | | | | |
| 48) Provide an example of performance criteria (or rubric) used to introduce and evaluate a project or unit | | | | | |
| 49) Documentation of extra help/tutoring sessions before, during, or after school | | | | | |
| 50) Evidence of homework policy (program or school) | | | | | |
| ***7c. The program contributes to increases in teacher/faculty knowledge of effective teaching and learning theory and practice.*** | | | | | |
| 51) Serving as mentor or supervising teacher to new teacher, student teacher, or career switcher | | | | | |
| 52) Evidence of teacher/leader activities (e.g., peer coaching, learning walks, department chairperson, curriculum development) | | | | | |
| 53) National Board for Professional Teaching Standards (NBPTS) Certification, if applicable | | | | | |
| Standard 7 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 7: | | | | | |

| B. EDUCATIONAL SIGNIFICANCE | | | | | |
|---|---|---|---|---|---|
| **8. The program design is innovative, dynamic, and reflective of current research.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***8a. The program design includes flexible delivery, interdisciplinary collaboration, integration of instructional technologies, and ability to change and adapt to current trends.*** | | | | | |
| 54) Provide one example of an interdisciplinary/collaborative lesson or project description | | | | | |
| 55) Examples of grants/awards/ recognition applied for and/or received | | | | | |
| 56) Examples of how instructional technology is used to add rigor and relevance to classroom instruction | | | | | |
| ***8b. The instructional methods include authentic instruction and assessment, problem- and project-based learning, mentoring, and other practices that develop students' critical thinking skills.*** | | | | | |
| 57) Provide three lesson plans that involve students demonstrating critical thinking skills solving skills. Highlight specific examples. | | | | | |
| 58) Examples of completed student assignments from the sample lesson plans in 57 above. | | | | | |
| 59) Provide one example of project- or problem-based learning unit | | | | | |
| 60) Describe three instructional practices resulting from participation in professional development activities | | | | | |
| ***8c. Professional development for the faculty and staff addresses identified needs for program improvement.*** | | | | | |
| 61) Agendas from professional development or professional learning community within past three years | | | | | |
| 62) Documentation of leading staff development at local, regional, state, or national levels during last three years | | | | | |
| 63) Documentation of service on school, division, state and/or national committees related to program area (during last three years) | | | | | |
| 64) Evidence of published articles | | | | | |
| 65) Copy of most recent professional teaching license renewal report | | | | | |
| **8d. Program design includes emerging *green* sustainability skills** | | | | | |
| 66) Describe *green*-oriented, CTSO community service or classroom projects | | | | | |
| 67) Create a list of *green* competencies that could enhance program curriculum | | | | | |
| 68) Provide one lesson plan that promotes sustainability practices | | | | | |
| 69) Document classroom practices that support sustainability | | | | | |
| Standard 8 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 8: | | | | | |

| C. EVIDENCE OF EFFECTIVENESS AND SUCCESS | | | | | |
|---|---|---|---|---|---|
| **9. The program makes a measurable difference in learning for all participants.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***9a. Learners demonstrate competency attainment in required academic, technical, and employability skills (Virginia's Workplace Readiness Skills), as evidenced by recognized standards-based assessments.*** | | | | | |
| 70) Complete the Student Credentialing Data CHART | | | | | |
| 71) Provide a sample of a completed student competency record | | | | | |
| • *Access to all student competency records during site visit* | | | | | |
| ***9b. Learners are able to perform acquired skills as evidenced by licensure, certification, credentialing, proficiency tests, and/or other recognized assessments.*** | | | | | |
| *Provided in data CHART (Artifact 70)* | | | | | |
| ***9c. Students successfully transition into further education or training, the workforce, or military service.*** | | | | | |
| 72) Provide at least three anecdotal student success stories | | | | | |
| ***9d. The gap in achievement among groups of students is narrowed.*** | | | | | |
| 73) Complete the Student Enrollment Data CHART | | | | | |
| 74) Provide an analysis of disaggregated student enrollment data (three years) | | | | | |
| 75) Complete the Competency Attainment Data CHART | | | | | |
| 76) Provide of an analysis of disaggregated competency attainment data (three years) | | | | | |
| 77) Provide an analysis of disaggregated CTE certification data (three years) | | | | | |
| Standard 9 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 9: | | | | | |

| C. EVIDENCE OF EFFECTIVENESS AND SUCCESS | | | | | |
|---|---|---|---|---|---|
| **10. The program exceeds identified performance goals.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***10a. Program data show that it exceeds local- or state- identified performance measures.*** | | | | | |
| 78) Program exceeds one or more locally determined benchmark standards | | | | | |
| 79) Provide ranking of certifications and credentials for 2010-2011 as compared to other programs in the school, the school division, and state | | | | | |
| Standard 10 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 10: | | | | | |

| C. EVIDENCE OF EFFECTIVENESS AND SUCCESS | | | | | |
|---|---|---|---|---|---|
| **11. A systematic evaluation process ensures the program's continuous improvement.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***11a. The program evaluates learner and program performance using valid outcome measures.*** | | | | | |
| 80) Provide evidence of self-analysis of program (result of local Exemplary Standards Program or other rubric). | | | | | |
| ***11b. The program solicits external stakeholders' feedback for program improvement.*** | | | | | |
| 81) Describe how feedback from parents, business, and community is attained and used for program improvement | | | | | |
| ***11c. The program solicits learner feedback to improve the program.*** | | | | | |
| 82) Identify how feedback from students and graduates (completers) is attained and used for program improvement | | | | | |
| ***11d. The program solicits staff feedback in identifying needs and assessing continuous improvement strategies.*** | | | | | |
| 83) Explain how teachers are involved in identifying needs and assessing continuous improvement strategies | | | | | |
| ***11e. Formative and summative information is collected and used to improve programs.*** | | | | | |
| 84) Analyze data CHARTS and identify program challenges (limit to one-page narrative) | | | | | |
| a) CTSO Data CHART (# 36) | | | | | |
| b) Co-op and Wage Data CHART (# 43) | | | | | |
| c) Student Credentialing Data CHART (# 71) | | | | | |
| d) Student Enrollment Data CHART(# 73) | | | | | |
| e) Competency Attainment Data CHART (# 75) | | | | | |
| 85) Identify three strategies that will be used to address challenges identified in program trend data analysis | | | | | |
| Standard 11 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 11: | | | | | |

| C. EVIDENCE OF EFFECTIVENESS AND SUCCESS | | | | | |
|---|---|---|---|---|---|
| **12. The whole program, the process, or significant elements of the program can be successfully implemented, adopted or adapted in other educational settings.** | **POINTS** | | | | **COMMENTS** |
| | **2** | **1** | **0** | **NA** | |
| ***12a. The program has sufficient documentation and specifies the conditions and resources needed for implementation.*** | | | | | |
| 86) Program has materials including handbook, inventory, and instructional guides that are clearly developed | | | | | |
| • *Access to all developed program materials during site visit* | | | | | |
| ***12b. The program's best practices are shared proactively and made available for duplication and adaptation in other settings.*** | | | | | |
| 87) Document presentations made about program to other groups | | | | | |
| 88) Description of the best practices of this program (limited to one page narrative) | | | | | |
| Standard 12 Points Awarded by Evaluator: Sum each column | | | | | |
| TOTAL Points Standard 12 | | | | | |

# APPENDIX J

# Course Descriptions

# APPENDIX J

## *Course Descriptions*

In addition to courses in English, mathematics, social studies, science, health and physical education, art, and world language, students in the STEM Academy will choose from sequences of the following STEM-related courses to complete the Academy:

## 8435 Technical Drawing and Design

***Suggested Grade Level:*** 9, 10, 11

***Description:*** In this foundation course, students learn the basic language of technical design, while they design, sketch, and make technical drawings, illustrations, models, or prototypes of real design problems. Students develop spatial ability as they apply mathematical concepts to visual representations. The course is especially recommended for future engineering and architecture students.

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- ADDA Architectural Drafting
- ADDA Architectural Drafting Apprentice
- ADDA Mechanical Drafting
- ADDA Mechanical Drafting Apprentice
- Architectural Drafting (NOCTI)
- AutoCAD
- Autodesk Application
- Autodesk Certified User
- Certified Solid Works Associate
- Certified Solid Works Professional
- National Career Readiness
- Technical Drafting (SkillsUSA)
- Workplace Readiness Skills for the Commonwealth

## 8436: Engineering Drawing and Design

***Suggested Grade Level:*** 10, 11, 12

***Prerequisites:*** 8435

***Description:*** Students explore the engineering design process and use a graphic language for product design, technical illustration, assembly, patent, and structural drawings. They increase their understanding of drawing and the design process and techniques learned in the prerequisite

course. Students use computers, calculators, and descriptive geometry and adhere to established standards to solve design problems.

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- Architectural Drafting (NOCTI)
- AutoCAD
- Autodesk Application
- Autodesk Certified User
- Certified SolidWorks Associate
- Certified SolidWorks Professional
- Engineering Technology
- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 8437: Architectural Drawing and Design

***Suggested Grade Level:*** 10, 11, 12

***Prerequisites***: 8435

***Description***: Students explore architectural design foundations and increase understanding of working drawings, construction techniques, and codes regulating building design. They learn the design process and apply the elements and principles of design to architectural projects. Through producing models and illustrations of all aspects of a building, students create architectural design solutions using CADD (computer aided drafting and design).

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- ADDA Architectural Drafting
- ADDA Architectural Drafting Apprentice
- ADDA Mechanical Drafting
- ADDA Mechanical Drafting Apprentice
- Architectural Drafting (NOCTI)
- Architectural Drafting (SkillsUSA)
- AutoCAD
- Autodesk Application
- Autodesk Certified User
- Certified SolidWorks Associate
- Certified SolidWorks Professional
- National Career Readiness
- Web Design and Development
- Workplace Readiness Skills for the Commonwealth

## 8438: Advanced Drawing and Design

***Suggested Grade Level:*** 11, 12

***Description***: Students use a graphic language for product design and technical illustration. They increase their understanding of drawing techniques learned in the prerequisite courses. They research design-related fields while identifying the role of advanced drawing and design in manufacturing and construction industry processes. They apply the design process, analyze design solutions, reverse engineer products, create 3-D solid models using CADD, construct physical models, and create multimedia presentations of finished designs. They complete a work portfolio based on a chosen graphic project.

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- ADDA Architectural Drafting
- ADDA Architectural Drafting Apprentice
- ADDA Mechanical Drafting
- ADDA Mechanical Drafting Apprentice
- Architectural Drafting (NOCTI)
- AutoCAD
- Autodesk Application
- Autodesk Certified User
- Certified SolidWorks Associate
- Certified SolidWorks Professional
- National Career Readiness
- Web Design and Development
- Workplace Readiness Skills for the Commonwealth

## 8439: Introduction to Engineering Design (PLTW)

***Suggested Grade Level:*** 9, 10

***Description***: In this Project Lead the Way (PLTW) foundation course, students use 3-D computer modeling software as they learn the engineering-design process and solve design problems for which they develop, analyze, and create product models.

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- CAD
- National Career Readiness
- Project Lead the Way
- Workplace Readiness Skills for the Commonwealth

## 8441: Principles of Engineering (PLTW)

***Suggested Grade Level:*** 9

***Description:*** In this Project Lead the Way (PLTW) foundation course, students explore the engineering profession and the fundamental aspects of engineering problem solving. Students study the historical and current impacts of engineering on society, including ethical implications. Mathematical and scientific concepts will be applied to fundamental engineering topics, including mechanics and electrical-circuit theory.

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- Engineering Technology
- National Career Readiness
- Pre-Engineering/Engineering Technology
- Project Lead the Way
- Workplace Readiness Skills for the Commonwealth

## 8442: Computer Integrated Manufacturing (PLTW)

***Suggested Grade Level:*** 11, 12

***Prerequisites***: 8441

***Description:*** In this Project Lead the Way (PLTW) specialization course, students are taught concepts of robotics and automated manufacturing by creating 3-D designs with computer modeling software and producing computer-controlled models of their designs.

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- Automated Manufacturing Technology
- CAD
- Electronics Module: AC, EM2
- Engineering Technology
- National Career Readiness
- Pre-Engineering/Engineering Technology
- Project Lead the Way
- Workplace Readiness Skills for the Commonwealth

## 8539: Precision Machining Technology I

***Suggested Grade Level***: 10, 11

***Description:*** Students learn the basics of industrial safety and environmental protection; planning, management, and performance of machining jobs; quality control; general maintenance; engineering drawings and sketches; and application of measurements, metalworking theory, properties of materials, and principles of CNC. Precision Machining Technology programs may be certified by NTMA (National Tooling and Machining Association), the certifying agency for the National Institute for Metalworking Skills (NIMS).

***Available Industry Certifications***
This course may assist the student in preparing for the following certification examinations, national assessments, or licensure examinations approved by the Virginia Board of Education:

- CNC Milling and Turning Technology
- Customer Service
- Machining, Level 1
- National Career Readiness
- Precision Machining
- Workplace Readiness Skills for the Commonwealth

## 8540: Precision Machining Technology II

***Suggested Grade Level:*** 11, 12

***Prerequisites:*** 8539

***Description***: Students apply industrial safety and environmental protection; planning, management, and performance of machining jobs; quality control; process improvement; general maintenance; engineering drawings and sketches; and application of measurements, metalworking theory, properties of materials, and principles of CNC. Precision Machining Technology programs may be certified by NTMA (National Tooling and Machining Association), the certifying agency for the National Institute for Metalworking Skills (NIMS). The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

***Available Industry Certifications***

- CNC Milling and Turning Technology
- Customer Service
- Machining, Level 1
- National Career Readiness
- Precision Machining
- Workplace Readiness Skills for the Commonwealth

## 8672: Welding I

***Suggested Grade Level:*** 10, 11

***Description***: Welding is required by a wide variety of industries, anywhere fusible materials and high heat are needed to manufacture, repair, or alter tools and products. Professional welders are in high demand and can earn accordingly. Students in Welding I are taught to use manual welding, cutting, and electric arc welding processes to fabricate and weld metal parts according to diagrams, blueprints, and specifications. Students will also receive all safety-related practices and techniques, including the OSHA 10 card.

***Available Industry Certifications***

- Core: Introductory Craft Skills
- Customer Service
- National Career Readiness
- SENSE Entry Welder
- Welding (NCCER)
- Welding (NOCTI)
- Welding (SkillsUSA)
- Workplace Readiness Skills for the Commonwealth

## 8673: Welding II

***Suggested Grade Level:*** 11, 12

***Prerequisites***: 8672

***Description***: This course teaches advanced welding students to fine-tune their craft and to perform V-groove welds in all positions, using multiple welding processes. Students prepare to pass relevant industry certifications. Welding is required by a wide variety of industries, anywhere fusible materials and high heat are needed to manufacture, repair, or alter products. Professional welders are in high-demand and can earn accordingly. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

***Available Industry Certifications***

- Core: Introductory Craft Skills
- Customer Service
- National Career Readiness
- SENSE Entry Welder
- Welding (NCCER)
- Welding (NOCTI)
- Welding (SkillsUSA)
- Workplace Readiness Skills for the Commonwealth

## 8674: Welding III - Proposed Course

***Suggested Grade Level:*** 12

***Prerequisites***: 8673

***Description***: This capstone course in welding teaches the industry's emerging technologies, including exotic metals and their applications, and how to master gas tungsten arc welding (GTAW) and shielded metal arc welding (SMAW) pipe tests. Students are prepared to earn relevant industry credentials toward employment in production or manufacturing facilities.

***Available Industry Certifications***

- Customer Service
- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 6612: Computer Information Systems

***Suggested Grade Level:*** 10, 11, 12

***Description***: Students apply problem-solving skills to real-life situations through word processing, spreadsheets, databases, multimedia presentations, and integrated software activities. Students work individually and in groups to explore computer concepts, operating systems, networks, telecommunications, and emerging technologies. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year. *Recommended prerequisite(s): Keyboarding course(s) or teacher-approved demonstration and documentation of touch keyboarding skills.*

***Available Industry Certifications***

- Administrative Assisting
- Administrative Services
- General Management
- Human Resources Management
- Internet and Computing Core Certification—IC3
- Microsoft Office Specialist—MOS
- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 6613: Computer Information Systems, Advanced

***Suggested Grade Level:*** 10, 11, 12

***Prerequisites***: 6612, 6614

***Description***: Students apply problem-solving skills to real-life situations through advanced integrated software applications, including printed, electronic, and Web publications. Students work individually and in groups to explore advanced computer maintenance activities, Web site development, programming, networking, emerging technology, and employability skills. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

***Available Industry Certifications***

- Administrative Assisting
- Administrative Services
- General Management
- Human Resources Management
- Internet and Computing Core Certification—IC3
- Microsoft Office Specialist—MOS
- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 6640: Programming

***Suggested Grade Level:*** 10, 11, 12

***Description***: Students explore computer concepts, apply logic procedures, and implement programming procedures with one or more languages, such as Visual Basic.Net, Java, C#, and C++. Graphical User Interfaces, such as Alice, Game Maker, and Flash, may be used as students design and develop interactive multimedia applications. In addition, HTML or JavaScript may be employed to create Web pages. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.
*Recommended prerequisite(s): Keyboarding course(s) or teacher-approved demonstration and documentation of touch keyboarding skills and Information Technology Fundamentals 6670.*

***Available Industry Certifications***

- Certified Internet Web Professional—CIW
- Computer Programming (NOCTI)
- Computer Programming (SkillsUSA)
- Internet and Computing Core Certification—IC3
- Microsoft Certified Professional—MCP
- National Career Readiness
- Software Development
- Workplace Readiness Skills for the Commonwealth

## 6641: Programming, Advanced

***Suggested Grade Level:*** 11, 12

***Prerequisites***: 6640

***Description***: Building on a foundation of programming skills, students will use object-oriented programming to develop applications for Windows, database, multimedia, games, mobile, and/or Web environments. Students will have the opportunity to explore and create applications related to the information technology and game design industries. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

***Available Industry Certifications***

- Certified Internet Web Professional—CIW
- Computer Programming (NOCTI)
- Computer Programming (SkillsUSA)
- Internet and Computing Core Certification—IC3
- Microsoft Certified Professional—MCP
- National Career Readiness
- Software Development
- Workplace Readiness Skills for the Commonwealth

## 8622: Computer Systems Technology I

***Suggested Grade Level:*** 10, 11, 12

***Description***: Students enter the world of computer technology and gain practical experience in assembling a computer system, installing an operating system, troubleshooting computers and peripherals, and using system tools and diagnostic software. They develop skills in computer networking and resource sharing. In addition, students explore the relationships between internal and external computer components. Emphasis is placed on customer service skills and career exploration. Upon successful completion of the course, students may qualify to take the A+ certification exam.

***Available Industry Certifications***

- A+ Essentials
- A+ Practical Application
- Business Information Processing
- CompTIA Strata Fundamentals of IT Technology
- Computer Maintenance Technology
- Computer Networking Fundamentals
- Computer Repair Technology
- Computer Service Technician—CST
- Computer Technology

- Customer Service
- IT Essentials: PC Hard
- Hardware and Software
- Microsoft Office Specialist—MOS
- Microsoft Technology Associate—MTA
- National Career Readiness
- Network Cabling Specialist
- Systems Administration
- Technical Support
- Workplace Readiness Skills for the Commonwealth

## 8623: Computer Systems Technology II

***Suggested Grade Level:*** 11, 12

***Prerequisites*:** 8622

***Description*:** Building on the foundation of Computer Systems Technology I, this advanced course provides students with training in procedures for optimizing and troubleshooting concepts for computer systems and subsystems. Students explore wireless technologies (e.g., Bluetooth, Wi-Fi) and create and configure a network. Emphasis is placed on technical proficiency, skill-building, and workplace readiness. The course prepares students for postsecondary education and training and a successful career in information technology. Upon successful completion of the course, students may qualify to take the A+ certification exam. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

**Industry Certifications**

- A+ Essentials
- A+ Practical Application
- Business Information Processing
- CompTIA Strata Fundamentals of IT Technology
- Computer Maintenance Technology
- Computer Networking Fundamentals
- Computer Repair Technology
- Computer Service Technician—CST
- Computer Technology
- Customer Service
- IT Essentials: PC Hardware and Software
- Microsoft Office Specialist—MOS
- Microsoft Technology Associate—MTA
- National Career Readiness
- Network Cabling Specialist
- Systems Administration
- Technical Support
- Workplace Readiness Skills for the Commonwealth

## 6650: Computer Network Software Operations

***Suggested Grade Level:*** 11, 12

***Prerequisites:*** 6670, Keyboarding course(s) or teacher-approved demonstration and documentation of touch keyboarding skills

***Description***: Computer Network Software Operations is designed to teach many aspects of computer support and network administration. Students learn networking concepts, from usage to components, and set up peer-to-peer network systems and client server networks. Students install and configure network cards and connect them to networks. Students learn how to install the operating systems, set up and manage accounts, load software, and set up and implement security plans. This course may include software-based network operating systems such as Novell NetWare and Microsoft Windows NT. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

***Available Industry Certifications***

- A+ Essentials
- A+ Practical Application
- Business Information Processing
- Certified Internet Web Professional—CIW
- Certified Novell Administrator—CNA
- CompTIA Strata Fundamentals of IT Technology
- Computer Maintenance Technology
- Computer Networking Fundamentals
- Computer Repair Technology
- Computer Technology
- Internet and Computing Core Certification—IC3
- Internetworking
- IT Essentials: PC Hardware and Software
- Linux+
- Microsoft Certified Professional—MCP
- Microsoft Office Specialist—MOS
- Microsoft Technology Associate—MTA
- National Career Readiness
- Network Administration
- Network+
- Systems Administration
- Technical Support
- Workplace Readiness Skills for the Commonwealth

## 6651: Computer Network Software Operations, Advanced

***Suggested Grade Level***: 12

***Prerequisites***: 6650

***Description***: Advanced Computer Network Software Operations is designed to continue teaching aspects of network administration-focusing on management and support of network users and systems. Time is spent discussing responsibilities of computer professionals, training end users, evaluating new technology, developing system policies, troubleshooting workstations, managing network services and protocols, and effectively using e-mail and business communications. Students learn communications protocols, troubleshooting techniques for systems and client server networks, Web site management, and other advanced networking topics. They learn advanced techniques to install the operating systems, set up and manage accounts, load software, and set up and implement security plans. This course may include software-based network operating systems such as Novell NetWare and Microsoft Windows NT. The cooperative education method is available for this course. Students combine classroom instruction and supervised on-the-job training in an approved position with continuing supervision throughout the school year.

***Available Industry Certifications***

- A+ Essentials
- A+ Practical Application
- Business Information Processing
- Certified Internet Web Professional—CIW
- Certified Novell Administrator—CNA
- CompTIA Strata Fundamentals of IT Technology
- Computer Maintenance Technology
- Computer Networking Fundamentals
- Computer Repair Technology
- Computer Technology
- Internet and Computing Core Certification—IC3
- Internetworking
- IT Essentials: PC Hardware and Software
- Linux+
- Microsoft Certified Professional—MCP
- Microsoft Office Specialist—MOS
- Microsoft Technology Associate—MTA
- National Career Readiness
- Network Administration
- Network+
- Systems Administration
- Technical Support
- Workplace Readiness Skills for the Commonwealth

## 8421: Technology of Robotics Design

***Suggested Grade Level:*** *9, 10, 11*

***Prerequisites***: None

***Description***: Students engage in the study of computers and microprocessors and their applications to manufacturing, transportation, and communication systems. Topics include computer equipment and operating systems, robotics, programming, control systems, and social/cultural impact of these technologies. Problem-solving activities challenge students to design, program, and interface devices with computer systems. Learning activities include robotics, computer-aided design, computer-aided manufacturing and design, and control of electromechanical devices.

***Available Industry Certifications***

- National Career Readiness
- Robotics and Automation Technology
- Workplace Readiness Skills for the Commonwealth

## 8403: Technology Foundations

***Suggested Grade Level:*** *9, 10, 11*

***Prerequisites***: None

***Description***: In this beginning high school course, students acquire a foundation in technological resources including material, energy, and information and apply processes associated with the technological thinker. Challenged by laboratory activities, students create new ideas and innovations, build systems, and analyze technological products to learn further how and why technology works. They work in groups to build and control systems using engineering design in the development of a technology.

***Available Industry Certifications***

- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 8405: Technology Transfer

***Suggested Grade Level: 10, 11, 12***

***Prerequisites***: Technology Foundations

***Description***: Students work with a variety of computers, materials, and systems to improve their skills and knowledge. Groups work together, applying mathematics, science, and communication

concepts, on a project that combines systems such as production, energy, communication, transportation, biotechnology, and other technologies. Thematic activities engage students in community problems where they transfer the technological method to address recycling, space exploration, and housing.

***Available Industry Certifications***

- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 9811: Principles of Technology I

***Suggested Grade Level: 10, 11, 12***

***Prerequisites***: None

***Description***: Students in this single-period laboratory science course apply physics and mathematics concepts through a unified systems approach to develop a broad knowledge base of the principles underlying modern technical systems. Students study seven technical principles: force, work, rate, resistance, energy, power, and force transformers, emphasizing how each principle plays a unifying role in the operation of mechanical, fluid, electrical, and thermal systems in high-technology equipment. This "principles and systems" approach to studying these technical principles provides a foundation for further education and career flexibility as technology and technical systems advance.

***Available Industry Certifications***

- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

## 9812: Principles of Technology II

***Suggested Grade Level: 11, 12***

***Prerequisites***: 9811

***Description***: Students continue to apply physics and mathematics concepts through a unified systems approach to expand their knowledge base of the principles underlying modern technical systems. This course focuses on seven technical principles: momentum, waves, energy converters, transducers, radiation, optical systems, and time constants, emphasizing how each principle plays a unifying role in the operation of mechanical, fluid, electrical, and thermal systems in high-technology equipment. This "principles and systems" approach to studying these technical principles provides a foundation for further education and career flexibility as technology and technical systems advance.

***Available Industry Certifications***

- National Career Readiness
- Workplace Readiness Skills for the Commonwealth

# APPENDIX K

# Academy Framework

# Appendix K

## Academy Framework

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Science, Technology, Engineering and Mathematics*** | Engineering and Technology<br><br>(Computer Science option is available in this pathway) | **8435** Technical Drawing and Design, DE<br>**8436** Engineering Drawing and Design, DE<br>**8437** Architectural Drawing and Design, DE<br>**8438** Advanced Drawing and Design, DE<br>**8439** Introduction to Engineering Design, DE<br>**8441** Principles of Engineering, DE<br>**8442** Computer Integrated Manufacturing, DE<br>8430 Civil Engineering and Architecture<br><br>**6630** Design, Multimedia and Web Technologies, DE<br>**6670** Information Technology Fundamentals Systems, DE | **TECHNICAL DRAWING AND DESIGN**<br>**DE8435** Technical Drawing and Design<br>**DE8436** Engineering Drawing and Design<br>**DE8437** Architectural Drawing and Design<br>**DE8438** Advanced Drawing and Design<br><br>**PRE-ENGINEERING**<br>**DE8439** Introduction to Engineering Design<br>**DE8441** Principles of Engineering<br>**DE8442** Computer Integrated Manufacturing<br>**DE8430** Civil Engineering and Architecture | Aeronautical/Aerospace Engineer,<br>Agricultural Engineer/Technician,<br>Application Engineer,<br>Architectural Engineer,<br>Automotive Engineer,<br>CAD Technician,<br>Civil Engineer,<br>Communications Engineer,<br>Computer Engineer,<br>Computer Hardware Engineer,<br>Computer Programmer,<br>Construction Engineer,<br>Drafter,<br>Electrical/Electronic/Engineering Technician,<br>Electrical Engineer,<br>Geothermal Engineer,<br>Industrial Engineer/Technician,<br>Manufacturing Engineer/Technician,<br>Marine Engineer,<br>Mechanical Engineer,<br>Metallurgist,<br>Mining Engineer,<br>Nuclear Engineer,<br>Petroleum Engineer,<br>Product/Process Engineer,<br>Systems Engineer,<br>Transportation Engineer |

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br><br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br><br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Manufacturing*** | Manufacturing Production Process and Development (Machine Technology AS Degree) | **8425** Manufacturing Technology<br>**8433** Materials and Processes<br>**8439** Precision Machining I<br>**8540** Precision Machining II, DE<br>**8541** Precision Machining III<br>**8425** Manufacturing Technology<br>**8433** Materials and Processes | **Precision Machining**<br>**8439** Precision Machining I<br>**DE8540** Precision Machining II | CNC Operator,<br>Inspector (Quality Control),<br>Machine Tool Operator,<br>Machinist,<br>Numerical Control,<br>Machine Tool Operator,<br>Materials Inspector,<br>Machine Tool Set-up Operator,<br>Mechanical Inspector,<br>Industrial Machinery Mechanic,<br>Numerical and Process Control Programmer |

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br><br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br><br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Manufacturing*** | Manufacturing Production Process and Development (Machine Technology NRCC Diploma) | **8425** Manufacturing Technology<br>**8433** Materials and Processes<br>**8439** Precision Machining I<br>**8540** Precision Machining II, DE<br>**8541** Precision Machining III<br>**8425** Manufacturing Technology<br>**8433** Materials and Processes | **Precision Machining**<br>**8439** Precision Machining I<br>**DE8540** Precision Machining II | Machine Tool Operator, Materials Inspector, Machine Tool Set-up Operator, Mechanical Inspector, Industrial Machinery Mechanic,<br>, |

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br><br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br><br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Manufacturing*** | Production (Welding NRCC Certificate) | **8425** Manufacturing Systems I<br>**8433** Materials and Processes<br>**8425** Manufacturing Technology<br>**8433** Materials and Processes<br>**89190** Welding I, DE<br>**80191** Welding II, DE | **Welding**<br>**DE89190** Welding I<br>**DE80191** Welding II<br>**8674** Welding | Combination Welder, Fitter-Welder, Materials Inspector Visual Inspector Welder, Welder and Cutter (Burner), Welder-Fitter |

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br><br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br><br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Information Technology*** | Programming and Software Development | **6612** Computer Information Systems, DE<br>**6640** Programming, DE<br>**6641** Advanced Programming<br>**6612** Computer Information<br>**6613** Advanced Computer Information Systems<br>**8621** Computer Maintenance Advanced<br>**8622** Computer Systems Technology I<br>**8623** Computer Systems Technology II<br>**8624** Computer Systems Technology III<br><br>**6630** Design, Multimedia and Web Technologies, DE<br>**6670** Information Technology Fundamentals Systems, DE | **Computer Programming**<br>**DE6612** Computer Information Systems<br>**6613** Advanced Computer Information Systems<br>**DE6640** Programming,<br>**DE6641** Advanced Programming | Software Applications Architect,<br>Operating Systems Designer/Engineer,<br>Programmer,<br>Game Programmer,<br>Applications Engineer,<br>Modeling and Simulation Programmer<br>Account Manager,<br>Applications Integrator,<br>Data Systems Designer,<br>Database Administrator,<br>Database Analyst,<br>E-Business Specialist,<br>Information Systems Architect,<br>Instructional Designer,<br>Maintenance Technician,<br>Product Support Engineer,<br>Support Engineer,<br>Systems Analyst,<br>Technical Communicator,<br>Testing Engineer |

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br><br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br><br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Information Technology*** | Information Support Services | **6612** Computer Information Systems, DE<br>**6640** Programming, DE<br>**6641** Advanced Programming<br>**6612** Computer Information<br>**6613** Advanced Computer Information Systems<br>**8621** Computer Maintenance Advanced<br>**8622** Computer Systems Technology I<br>**8623** Computer Systems Technology II<br>**8624** Computer Systems Technology III<br><br>**6630** Design, Multimedia and Web Technologies, DE<br>**6670** Information Technology Fundamentals Systems, DE | **Computer Information Systems**<br>**6612** Computer Information Systems<br>**DE6613** Advanced Computer Information Systems<br><br>**Computer Systems Technology**<br>**8621** Computer Maintenance Advanced<br>**8622** Computer Systems Technology I<br>**8623** Computer Systems Technology II<br>**8624** Computer Systems Technology III | Account Manager,<br>Applications Integrator,<br>Call Center Support Representative,<br>Customer Service Representative,<br>Data Systems Designer,<br>Database Administrator,<br>Database Analyst,<br>E-Business Specialist,<br>Help Desk Specialist,<br>Instructional Designer,<br>Maintenance Technician,<br>PC Support Specialist,<br>PC Systems Coordinator, |

| Career Cluster | Career Pathway | Governor's STEM Academy Courses<br><br>*DE indicates a course that is dual enrolled for college credit | Completer Sequences<br><br>*DE indicates a course that is dual enrolled for college credit | Sample Occupations by Career Pathway |
|---|---|---|---|---|
| ***Information Technology (cont.)*** | Network Systems | **6650** Computer Network Software Operations I<br>**6651** Computer Network Software Operations II<br><br>**6640** Programming<br>**6670** Information Technology Fundamentals Systems, DE | **<u>Computer Networking</u>**<br>**6650** Computer Network Software Operations I<br>**6651** Computer Network Software Operations II | Communications Analyst,<br>Information Systems Administrator,<br>Information Systems Operator,<br>Information Technology Engineer,<br>Network Administrator,<br>Network Architect,<br>Network Engineer,<br>Network Manager,<br>Network Operations Analyst,<br>Network Security Analyst,<br>PC Support/User Specialist,<br>Systems Administrator,<br>Technical Support Specialist,<br>Telecommunications Network Technician |

| Career Cluster | Career Pathway | Additional Courses / Capstone Experience |
|---|---|---|
| **All Academy Clusters** | **All Academy Pathways** | **<u>FIRST Robotics</u>**<br>**98281** Robotics I<br>**98282** Robotics II<br>**98283** Robotics III<br>**8216** Internship<br><br>**9811** Principles of Technology I<br>**9812** Principles of Technology II<br>**8421** Technology of Robotic Design<br>**8405** Technology Transfer |

# APPENDIX L

## MCPS Governor's STEM Academy Bell Schedule

| | |
|---|---|
| BLOCK 1: | 7:50 – 9:20 |
| BLOCK 2: | 9:25 – 10:55 |
| A LUNCH: | 10:55 – 11:25 |
| BLOCK 3: | 11:30 – 1:00 |
| B LUNCH: | 11:45 – 12:15 |
| BLOCK 3: | 11:00-11:45; 12:20 – 1:00 |
| C LUNCH: | 12:30 – 1:00 |
| BLOCK 3: | 11:00 – 12:30 |
| BLOCK 4: | 1:05 – 2:35 |
| BLOCK 0: | 5:00 - 8:00 M, T, W |

# APPENDIX M

## Plans of Study

# Montgomery County Public Schools
# Plan of Study

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:STEM___** **Pathway:** Engineering and Technology - Associates Degree

*This Career Pathway Plan of Study (based on the Interactive Media Pathway of the Information Technology Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. *This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses | SAMPLE – Occupations Relating to This Pathway: |
|---|---|---|---|---|---|---|---|---|
| **Graduation Requirements: http://www.doe.virginia.gov/2plus4in2004/index.shtml** | | | | | | | | Aeronautical/Aerospace Engineer<br>- Agricultural Engineer/Technician<br>- Application Engineer<br>- Architectural Engineer<br>- Automotive Engineer<br>- Biomedical/Biotechnology Engineer<br>- CAD Technician<br>- Chemical Engineer<br>- Civil Engineer<br>- Communications Engineer<br>- Computer Engineer<br>- Computer Hardware Engineer<br>- Computer Programmer<br>- Construction Engineer<br>- Drafter<br>- Electrical/Electronic/Engineering Technician<br>- Electrical Engineer<br>- Geothermal Engineer<br>- Industrial Engineer/Technician<br>- Manufacturing Engineer/Technician<br>- Marine Engineer<br>- Mechanical Engineer<br>- Metallurgist<br>- Mining Engineer<br>- Nuclear Engineer<br>- Petroleum Engineer<br>- Product/Process Engineer<br>- Survey Technician<br>- Systems Engineer<br>- Transportation Engineer |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | I | Technological Systems (8463/8462) | |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) or Algebra I (3130) | Physical Science (4125) | Civics & Economics (2357) | Inventions and Innovations (8465) | Technology Foundations (8402/8403) | |
| **Career Assessment:** Administration of a career assessment instrument is appropriate at the middle school level to help students and their parents plan for high school (Virginia's Career Planning System or other assessment product). | | | | | | | | |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE<br>Economics & Personal Finance (6120)<br>Health & PE (2 years)<br>Foreign Language (3 years) Including AP French, AP Latin, AP Spanish<br><br>Other Electives to Complement Pathway (Core Academic and CTE):<br><br>Technical Drawing and Design (DE8435, 8436, 8437, 8438),<br>Pre-Calculus (3162),<br>Multivariate Calculus (3178) | *Technology Transfer (8405)* | |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | *Introduction to Engineering Design (DE8439)* | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | *Principles of Engineering (DE844a)* | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | *Computer Integrated Manufacturing (DE8442)* | |
| **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**List related certifications/credentials approved by VDOE and offered locally:**
http://www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ (Go to Section 9.)

- Engineering Technology
- National Career Readiness
- Pre-Engineering/Engineering Technology
- Project Lead the Way
- Workplace Readiness Skills for the Commonwealth

**Additional Learning Opportunities:**
CTSO Organization(s): ☐ DECA ☐ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA ☒ SkillsUSA ☒ TSA

**Work-Based Learning:**
☐ Career Research ☒ Cooperative Education ☒ Internship ☐ Mentorship
☒ Job Shadowing ☐ Service Learning Project ☐ Student Apprenticeship

**Postsecondary**: Placement Assessments such as COMPASS & SAT II

College Entrance Exams such as ACT & SAT

**POSTSECONDARY**

**SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY**
Individual plans must include locally agreed upon courses at the postsecondary level (See page 2)

| Pathway | Associate Degree, College Certificate, or Apprenticeship | Bachelors Degree | Postgraduate Degree |
|---|---|---|---|

**College:** NRCC **School Division(s):** _____

**Postsecondary:** Placement Assessments such as COMPASS & SAT II

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | ENG 111 College Composition I (DE Enrollment) | Math 175 Calculus of One Variable I | CHM 111 College Chemistry | SDV 100 College Success Skills (or SDV 106) 1 credit | EGR 120 introduction to Engineering | Math 177 Introduction to Linear Algebra | Humanities Elective | |
| Year 1 2nd Semester | ENG 112 College Composition II (DE Enrollment) | Math 176 Calculus with One Variable II | CHM 112 College Chemistry II | | EGR 115 Engineering Graphics (with AutoCad) | EGR 126 Computer Programming for Engineers (C++) | Math 178 Topics in Analytic Geometry | |
| Year 2 1st Semester | | Math 277 Vector Calculus | | PHY 231 University Physics I | EGR 140 Engineering Mechanics- Statics | Humanities Elective | Social Science Elective | |
| Year 2 2nd Semester | | Math 279 Differential Equations | 1 | PHY 232 University Physics II | CST 100 Principles of Public Speaking | Health or Physical Education | Social Science Elective | |
| **College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**
☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

UNIVERSITY

University/College: VT
Degree or Major: Engineering
Number of Articulated CC Credits:

Notes:

# Montgomery County Public Schools
# Plan of Study

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:** Manufacturing **Pathway:** Manufacturing Production Process – Machine Technology AS Degree

*This Career Pathway Plan of Study (based on the Interactive Media Pathway of the Information Technology Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. *This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses<br>Source:<br>Administrative Planning Guide<br>www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ | SAMPLE – Occupations Relating to This Pathway:<br>www.doe.virginia.gov/VDOE/Instruction/CTE/careerclusters/<br>www.careerclusters.org<br>www.cteresource.org/cpg/ |
|---|---|---|---|---|---|---|---|---|
| **Graduation Requirements: http://www.doe.virginia.gov/2plus4in2004/index.shtml** | | | | | | | | CNC Operator • Inspector (Quality Control) • Machine Tool Operator • Machinist • Numerical Control Machine Tool Operator • Materials Inspector • Machine Tool Set-up Operator Mechanical Inspector • Industrial Machinery Mechanic • Numerical and Process Control Programmer |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | | **NOTE: Use state course title**<br>Keyboarding (6150) | |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) or Algebra I (3130) | Physical Science (4125) | Civics & Economics (2357) | Inventions and Innovations (8464) | Introduction to Technology (8482) | |
| **Career Assessment:** Administration of a career assessment instrument is appropriate at the middle school level to help students and their parents plan for high school (Virginia's Career Planning System or other assessment product). | | | | | | | | |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE<br>Economics & Personal Finance (6120)<br>Health & PE (2 years)<br>Foreign Language (3 years) Including AP French, AP Latin, AP Spanish<br><br>Other Electives to Complement Pathway (Core Academic and CTE):<br><br>Technical Drawing and Design (DE8435, 8436, 8437, 8438),<br>Pre-Calculus (3162),<br>Multivariate Calculus (3178 | Manufacturing Technology (8425)<br>Materials and Processes (8433) | |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | Precision Machining I (8539) | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | DE Precision Machining II (8540) | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | Precision Machining III (8541) | |
| | **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | |

**List related certifications/credentials approved by VDOE and offered locally:**
http://www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ (Go to Section 9.)

- CNC Milling and Turning Technology
- Customer Service
- Machining, Level 1
- National Career Readiness
- Precision Machining
- Workplace Readiness Skills for the Commonwealth

**Additional Learning Opportunities:**
CTSO Organization(s): ☐ DECA ☐ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA ☒ SkillsUSA ☐ TSA

**Work-Based Learning:**
☐ Career Research ☒ Cooperative Education ☒ Internship ☐ Mentorship
☒ Job Shadowing ☐ Service Learning Project ☐ Student Apprenticeship

**Postsecondary**: Placement Assessments such as COMPASS & SAT II

College Entrance Exams such as ACT & SAT

| POSTSECONDARY | SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY<br>Individual plans must include locally agreed upon courses at the postsecondary level (See page 2) | | | |
|---|---|---|---|---|
| | **Pathway** | **Associate Degree, College Certificate, or Apprenticeship** | **Bachelors Degree** | **Postgraduate Degree** |
| | Ma Manufacturing Production Process | Machine Technology Associates Degree | | |



**College:** NRCC **School Division(s):** _____

**Postsecondary:** Placement Assessments such as COMPASS & SAT II

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | | MTH 115 Technical Mathematics I | | SDV 100 College Success Skills (or SDV 106) 1 credit | MAC 106 Machine Shop Operations 9 credits | MAC 181 Machine Blueprint Reading I 3 credits | | |
| Year 1 2nd Semester | | | | Social Science Elective | MAC 107 Technology of Machining 9 credits | MAC 182 Machine Blueprint Reading II 3 credits | WEL 145 Welding Metallurgy 3 credits | |
| Year 2 1st Semester | Eng 115 Technical Writing | | | Social Science Elective | MAC 121 Computer Numerical Control I 3 credits | MAC 215 Machining Techniques 9 credits | | |
| Year 2 2nd Semester | CST 137 Oral interpretation or CST 100 & Humanities and Fine Arts | | | | MAC 122 Computer Numerical Control II 3 credits | MAC 217 Precision Machining Techniques 9 credits | Health or Physical Education | |
| **College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**

☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

| UNIVERSITY | University/College:<br>Degree or Major:<br>Number of Articulated CC Credits: |
| --- | --- |
| Notes: | |

# Montgomery County Public Schools
# Plan of Study

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:** Manufacturing **Pathway:** Manufacturing Production Process – Machine Shop Operations, Diploma

*This Career Pathway Plan of Study (based on the Interactive Media Pathway of the Information Technology Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. *This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses<br>Source:<br>Administrative Planning Guide<br>www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ | SAMPLE – Occupations Relating to This Pathway:<br>www.doe.virginia.gov/VDOE/Instruction/CTE/careerclusters/<br>www.careerclusters.org<br>www.cteresource.org/cpg/ |
|---|---|---|---|---|---|---|---|---|
| **Graduation Requirements: http://www.doe.virginia.gov/2plus4in2004/index.shtml** | | | | | | | | CNC Operator • Inspector (Quality Control) • Machine Tool Operator • Machinist • Numerical Control Machine Tool Operator • Materials Inspector • Machine Tool Set-up Operator Mechanical Inspector • Industrial Machinery Mechanic • Numerical and Process Control Programmer |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | | **NOTE: Use state course titles**<br>Keyboarding (6150) | |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) or Algebra I (3130) | Physical Science (4125) | Civics & Economics (2357) | Inventions and Innovations (8464) | Introduction to Technology (8482) | |
| **Career Assessment:** Administration of a career assessment instrument is appropriate at the middle school level to help students and their parents plan for high school (Virginia's Career Planning System or other assessment product). | | | | | | | | |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE<br>Economics & Personal Finance (6120)<br>Health & PE (2 years)<br>Foreign Language (3 years) Including AP French, AP Latin, AP Spanish<br><br>Other Electives to Complement Pathway (Core Academic and CTE): | Manufacturing Technology (8425)<br>Materials and Processes (8433) | |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | Precision Machining I (8539) | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | DE Precision Machining II (8540) | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | Precision Machining III (8541) | |
| | **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | |

**List related certifications/credentials approved by VDOE and offered locally:**
http://www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ (Go to Section 9.)

- CNC Milling and Turning Technology
- Customer Service
- Machining, Level 1
- National Career Readiness
- Precision Machining
- Workplace Readiness Skills for the Commonwealth

**Additional Learning Opportunities:**
CTSO Organization(s): ☐ DECA ☐ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA ☒ SkillsUSA ☐ TSA

**Work-Based Learning:**
☐ Career Research ☒ Cooperative Education ☒ Internship ☐ Mentorship
☒ Job Shadowing ☐ Service Learning Project ☐ Student Apprenticeship

**Postsecondary**: Placement Assessments such as COMPASS & SAT II

College Entrance Exams such as ACT & SAT

TSE CON DAR

**SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY**
Individual plans must include locally agreed upon courses at the postsecondary level (See page 2)

| Pathway | Associate Degree, College Certificate, or Apprenticeship | Bachelors Degree | Postgraduate Degree |
|---|---|---|---|
| Manufacturing Production Process | Machine Shop Operations Diploma | | |



**College:** NRCC **School Division(s):** _____

**Postsecondary:** Placement Assessments such as COMPASS & SAT II

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | | MTH 101 Basic Technical Mathematics 4 credits | | SDV 100 College Success Skills (or SDV 106) 1 credit | MAC 106 Machine Shop Operations 9 credits | MAC 181 Machine Blueprint Reading I 3 credits | | |
| Year 1 2nd Semester | ENG 108 Critical Reading & Study Skills 3 credits | | | | MAC 107 Technology of Machining 9 credits | MAC 182 Machine Blueprint Reading II 3 credits | | |
| Year 2 1st Semester | | | | | MAC 121 Computer Numerical Control I 3 credits | MAC 215 Machining Techniques 9 credits | Elective 3 credits | |
| Year 2 2nd Semester | | | | | MAC 122 Computer Numerical Control II 3 credits | MAC 217 Precision Machining Techniques 9 credits | WEL 145 Welding Metallurgy 3 credits | |
| **College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**

☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

| UNIVERSITY | University/College:<br>Degree or Major:<br>Number of Articulated CC Credits: |
| --- | --- |
| Notes: | |

# Montgomery County Public Schools
# Plan of Study

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:** Manufacturing **Pathway:** Production- Welding Certificate

*This Career Pathway Plan of Study (based on the Interactive Media Pathway of the Information Technology Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. *This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses Source: Administrative Planning Guide www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ | SAMPLE – Occupations Relating to This Pathway: www.doe.virginia.gov/VDOE/Instruction/CTE/careerclusters/ www.careerclusters.org www.cteresource.org/cpg/ |
|---|---|---|---|---|---|---|---|---|
| **Graduation Requirements: http://www.doe.virginia.gov/2plus4in2004/index.shtml** | | | | | | | | |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | | **NOTE: Use state course title** Keyboarding (6150) | |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) | Physical Science (4125) | Civics & Economics (2357) | Inventions and Innovations (8464) | Introduction to Technology (8482) | |
| **Career Assessment:** Administration of a career assessment instrument is appropriate at the middle school level to help students and their parents plan for high school (Virginia's Career Planning System or other assessment product). | | | | | | | | |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE Economics & Personal Finance (6120) Health & PE (2 years) Foreign Language (3 years) Including AP French, AP Latin, AP Spanish Other Electives to Complement Pathway (Core Academic and CTE): | Manufacturing Technology (8425) | Combination Welder Fitter-Welder Materials Inspector Visual Inspector Welder Welder and Cutter (Burner) Welder-Fitter |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | Materials and Processes (8433) | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | DE Welding I (8019) | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | DE Welding II (8019) | |
| **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**List related certifications/credentials approved by VDOE and offered locally:**
http://www.doe.virginia.gov/VDOE/Instruction/CTE/apg/ (Go to Section 9.)

- Core: Introductory Craft Skills
- Customer Service
- National Career Readiness
- SENSE Entry Welder
- Welding (NCCER)
- Welding (NOCTI)
- Welding (SkillsUSA)
- Workplace Readiness Skills for the Commonwealth

**Additional Learning Opportunities:**
CTSO Organization(s): ☐ DECA ☐ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA ☒ SkillsUSA ☐ TSA

**Work-Based Learning:**
☐ Career Research ☒ Cooperative Education ☒ Internship ☐ Mentorship
☒ Job Shadowing ☐ Service Learning Project ☐ Student Apprenticeship

**Postsecondary**: Placement Assessments such as COMPASS & SAT II

College Entrance Exams such as ACT & SAT

TSE CON DAR

**SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY**
Individual plans must include locally agreed upon courses at the postsecondary level (See page 2)

| Pathway | Associate Degree, College Certificate, or Apprenticeship | Bachelors Degree | Postgraduate Degree |
|---|---|---|---|
| Production | Welding Certificate | | |



**College:** NRCC **School Division(s):** Montgomery County

**Postsecondary:** Placement Assessments such as COMPASS & SAT II

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | | MTH 103 Applied Technical Math I 3 credits | | SDV 100 College Success Skills (or SDV 106) 1 credit | ITE 115 Intro to Computer Applications & Concepts 3 credits | MAC 131 Machine Lab I 2 credits | WEL 100 Fundamentals of Welding 3 credits | WEL 123 Shielded Metal ARC Welding (Basic) 4 credits |
| Year 1 2nd Semester | ENG 108 Critical Reading & Study Skills 3 credits | | | | WEL 124 Shielded Metal ARC Welding (Advanced) 4 credits | WEL 145 Welding Metallurgy 3 credits | WEL 150 Welding Drawing & Interpretation 2 credits | WEL 160 Gas Metal ARC Welding 4 credits |
| Year 2 1st Semester | | | | Social Science Elective 3 credits | WEL 127 Pipe Welding II 3 credits | WEL 130 Inert Gas Welding (GTAW) 4 credits | WEL 146 Welding Quality Control 3 credits | Elective 2-3 credits |
| Year 2 2nd Semester | | | | | | | | |
| **College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**

☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

| UNIVERSITY | University/College:<br>Degree or Major:<br>Number of Articulated CC Credits: |
| --- | --- |
| Notes: | |

CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Science, Technology, Engineering & Mathematics

# Montgomery County Public Schools Plan of Study

Rev: 6/12

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:** Information Technology **Pathway:** Programming and Software Development

*This Career Pathway Plan of Study can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses Source: Administrative Planning Guide http://www.cteresource.org/apg/ | SAMPLE – Occupations Relating to This Pathway: http://www.doe.virginia.gov/instruction/career_technical/career_clusters/sample_plans_study/index.shtml http://www.careerclusters.org http://www.cteresource.org/cpg/ |
|---|---|---|---|---|---|---|---|---|
| | | NOTE: Indicate State Course Titles and Codes | | | | | | |
| Graduation Requirements: http://www.doe.virginia.gov/instruction/graduation/index.shtml | | | | | | | | |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | 6609 Computer Solutions | 61500 Keyboarding | |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) or Algebra I (3130) | Physical Science (4125) | Civics & Economics (2357) | 8464 Inventions and Innovations | 84820 introduction to Technology | |
| **Career Assessment:** Identify an appropriate career assessment instrument at the middle school level used to help students and their parents plan for high school: VA Wizard ☐ or other assessment (please indicate): _____ | | | | | | | | ▪ Software Applications architect<br>▪ Operating Systems Designer/Engineer<br>▪ Programmer<br>▪ Game Programmer<br>▪ Applications Engineer<br>▪ Modeling and Simulation Programmer |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE<br>Economics & Personal Finance (6120)<br>Health & PE (2 years)<br>Foreign Language (3 years) Including AP French, AP Latin, AP Spanish)<br><br>Other Electives to Complement Pathway (Core Academic and CTE):<br><br>AP Computer Science (3185)<br>Design, Multimedia and Digital Input Technologies DE6630 | Computer Information Systems (6612) | |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | Advanced Computer Information Systems 6613 | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | Programming (6640) | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | Programming, Advanced (6641) | |
| | | **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | |

**List related certifications/credentials approved by VDOE and offered locally:**
http://www.cteresource.org/apg (Go to Certification – License Section)

- Certified Internet Web Professional—CIW
- Computer Programming (SkillsUSA)
- Internet and Computing Core Certification—IC3
- Microsoft Certified Professional—MCP
- Workplace Readiness Skills for the Commonwealth

**Additional Learning Opportunities:**
CTSO Organization(s): ☐ DECA ☐ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA x SkillsUSA ☐ TSA

**Work-Based Learning:**
x Career Research x Cooperative Education x Internship ☐ Mentorship
x Job Shadowing ☐ Service Learning Project ☐ Student Apprenticeship

**Postsecondary**: Placement Assessments such as Virginia Placement Test or COMPASS

College Entrance Exams such as ACT & SAT

| POSTSECONDARY | SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY<br>Individual plans must include locally agreed upon courses at the postsecondary level (See page 2) | | | |
|---|---|---|---|---|
| | **Pathway** | **Associate Degree, College Certificate, or Apprenticeship** | **Bachelors Degree** | **Postgraduate Degree** |
| | Programming and Software Development | General Studies, Computer Science Specialization, Associates Degree- Transfer | | |



**College:** New River Community College **School Division(s):** Montgomery County

**Postsecondary**: Placement Assessments such as Virginia Placement Test or COMPASS

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | ENG 111 College Composition I | | | HIS 111 History of World Civilization I (or HIS 121 or HIS 101) | CSC 110 Introduction to Computing | CSC 200 Introduction to Computer Science | SDV 100 College Success Skills | |
| Year 1 2nd Semester | ENG 112 College Composition II | MTH (confirm 4 year university requirement) | | HIS 112 History of World Civilization II Or HIS 122 or HIS 102) | CSC 205 Computer Organization (or IT Elective) | Humanities or Fine Arts Elective | | |
| Year 2 1st Semester | ENG 241 | | Natural Science with lab (BIO 101, CHM 111, OR PHY 201 | Social Sciences Elective | CSC 201 | Health or Physical Education | | |
| Year 2 2nd Semester | | | Natural Science with lab (BIO 102, CHM 112, OR PHY 202) | Social Science Elective | CSC 202 Computer Science II | CST 100 Principals of Public Speaking | | |
| **College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**

☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

| UNIVERSITY | University/College: Radford University<br>Degree or Major: Computer Science and Technology, Computer Science or Networks concentration<br>Number of Articulated CC Credits: 62 |
| --- | --- |
| Notes: | |

Rev: 6/12

CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Information Technology

# Commonwealth of Virginia Plan of Study

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:** Information Technology **Pathway:** Information Support and Services

*This Career Pathway Plan of Study can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses Source: Administrative Planning Guide http://www.cteresource.org/apg/ | SAMPLE – Occupations Relating to This Pathway: http://www.doe.virginia.gov/instruction/career_technical/career_clusters/sample_plans_study/index.shtml http://www.careerclusters.org http://www.cteresource.org/cpg/ |
|---|---|---|---|---|---|---|---|---|
| | | NOTE: Indicate State Course Titles and Codes | | | | | | |
| | | Graduation Requirements: http://www.doe.virginia.gov/instruction/graduation/index.shtml | | | | | | |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | Introduction to Technology 8481/8482 | Keyboarding (6150, 6151, or 6152) | • Account Manager<br>• Applications Integrator<br>• Call Center Support Representative<br>• Customer Service Representative<br>• Data Systems Designer<br>• Database Administrator<br>• Database Analyst<br>• E-Business Specialist<br>• Help Desk Specialist<br>• Information Systems Architect<br>• Instructional Designer<br>• Maintenance Technician<br>• PC Support Specialist<br>• PC Systems Coordinator<br>• Product Support Engineer<br>• Support Engineer<br>• Systems Analyst<br>• Technical Communicator<br>• Testing Engineer |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) or Algebra I (3130) | Physical Science (4125) | Civics & Economics (2357) | | | |
| **Career Assessment:** Identify an appropriate career assessment instrument at the middle school level used to help students and their parents plan for high school: VA Wizard ☒ or other assessment (please indicate): _____ | | | | | | | | |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE<br>Economics & Personal Finance (6120)<br>Health & PE (2 years)<br>Foreign Language (3 years) Including AP French, AP Latin, AP Spanish)<br><br>Other Electives to Complement Pathway (Core Academic and CTE):<br><br>Advanced Computer Information Systems 6613<br>AP Computer Science (3185)<br>DE Computer Information Systems (6612)<br>DE Design, Multimedia and Digital Input Technologies (6630)<br>Programming (6640)<br>Adv Programming (6641) | IT Fundamentals (6670 ) | |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | Computer Systems Tech I (8622) | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | Computer Systems Tech II (8623) OR | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | Computer Systems Tech III (8624)<br>Computer Maintenance (8621) | |
| | | **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | |

- **List related certifications/credentials approved by VDOE and offered locally:** http://www.cteresource.org/apg (A+ Essentials
- A+ Practical Application
- Business Information Processing
- CompTIA Strata Fundamentals of IT Technology
- Computer Maintenance Technology
- Computer Networking Fundamentals
- Computer Repair Technology
- Computer Service Technician—CST

**Additional Learning Opportunities:**

CTSO Organization(s): ☐ DECA ☒ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA ☒ SkillsUSA ☒ TSA

**Work-Based Learning:**

☐ Career Research ☒ Cooperative Education ☒ Internship ☒ Mentorship
☒ Job Shadowing ☐ Service Learning Project ☐ Student Apprenticeship

| | |
|---|---|
| • Computer Technology<br>• Customer Service<br>• IT Essentials: PC Hardware and Software<br>• Microsoft Office Specialist—MOS<br>• Microsoft Technology Associate—MTA<br>• National Career Readiness<br>• Network Cabling Specialist<br>• Systems Administration<br>• Technical Support<br>• Workplace Readiness Skills for the Commonwealth | |
| **Postsecondary**: Placement Assessments such as Virginia Placement Test or COMPASS | College Entrance Exams such as ACT & SAT |

| POSTSECONDARY | SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY<br>Individual plans must include locally agreed upon courses at the postsecondary level (See page 2) | | | |
|---|---|---|---|---|
| | **Pathway** | **Associate Degree, College Certificate, or Apprenticeship** | **Bachelors Degree** | **Postgraduate Degree** |
| | Information Support and Services | Computer Science – AS (Transfer)<br>Information Technology – AS (Transfer) | (Determined Locally) | (Determined Locally – Optional) |



**College:** New River Community College **School Division(s):** Montgomery County

**Postsecondary**: Placement Assessments such as Virginia Placement Test or COMPASS

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | Eng 111 College Composition I | MTH____ | | HIS 111 History of World Civilization I (or HIS 121 or HIS 101) | CSC 110 Introduction to Computing (DE6612) | CSC 200 Introduction to Computer Science | SDV 100 College Success Skills | |
| Year 1 2nd Semester | ENG 112 College Composition II | MTH _____ | | HIS 112 History of World Civilization II (or HIS 122 or HIS 102) | CSC 205 Computer Organization (or IT elective) | Humanities or Fine Arts Elective | | |
| Year 2 1st Semester | ENG 241 | | Natural I Science with lab | Social Science elective | CSC 201 Computer Science I | Health or Physical Education | | |
| Year 2 2nd Semester | | | Natural Science II with lab | Social Science elective | CSC 202 Computer Science | CST 100 Principles of Public Speaking | | |

**College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)**

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**

☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

| UNIVERSITY | University/College: Radford University<br>Degree or Major: Computer Science and Technology, Computer Science or Networks concentration<br>Number of Articulated CC Credits: 62 |
| --- | --- |
| Notes: | |

Rev: 6/12

CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Information Technology

# Commonwealth of Virginia Plan of Study

**Student Name:** _____
**School:** _____
**Date:** _____

**Cluster:** Information Technology **Pathway:** Network Systems

*This Career Pathway Plan of Study can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals. This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

| EDUCATION LEVELS | GRADE | English/ Language Arts | Mathematics | Science | Social Studies/ Science | Other Required Courses Recommended Electives Learner Activities | Recommended Career and Technical Courses Source: Administrative Planning Guide http://www.cteresource.org/apg/ | SAMPLE – Occupations Relating to This Pathway: http://www.doe.virginia.gov/instruction/career_technical/career_clusters/sample_plans_study/index.shtml http://www.careerclusters.org http://www.cteresource.org/cpg/ |
|---|---|---|---|---|---|---|---|---|
| | | NOTE: Indicate State Course Titles and Codes | | | | | | |
| Graduation Requirements: http://www.doe.virginia.gov/instruction/graduation/index.shtml | | | | | | | | • Communications Analyst<br>• Information Systems Administrator<br>• Information Systems Operator<br>• Information Technology Engineer<br>• Network Administrator<br>• Network Architect<br>• Network Engineer<br>• Network Manager<br>• Network Operations Analyst<br>• Network Security Analyst<br>• PC Support/User Specialist<br>• Systems Administrator<br>• Technical Support Specialist<br>• Telecommunications Network Technician |
| MIDDLE | 7 | English 7 (1110) | Math 7 (3111) | Life Science (4115) | U S History (2354) | | Keyboarding (6150) | |
| MIDDLE | 8 | English 8 (1120) | Math 8/Pre-Algebra (3112) or Algebra I (3130) | Physical Science (4125) | Civics & Economics (2357) | Computer Solutions (6609) | Digital Input Technologies (6161) | |
| **Career Assessment:** Identify an appropriate career assessment instrument at the middle school level used to help students and their parents plan for high school: VA Wizard ☒ or other assessment (please indicate): _____ | | | | | | | | |
| SECONDARY | 9 | English 9 (1130) | Algebra I (3130) or Geometry (3143) | Earth Sciences (4210) or AP Environmental Sciences (4270) | World History/ Geography (2215) | Health and PE<br>Economics & Personal Finance (6120)<br>Health & PE (2 years)<br>Foreign Language (3 years) Including AP French, AP Latin, AP Spanish<br>Other Electives to Complement Pathway (Core Academic and CTE):<br><br>AP Computer Science (3185)<br>DE Computer Information Systems (6612)<br>Adv Computer Information Systems (6613/6615)<br>Computer Systems Technology (I 8622, II 8623) | IT Fundamentals (6670) | |
| SECONDARY | 10 | English10 (1140) | Geometry (3143) or Algebra II ( 3135) | AP Biology (4370) | AP European History (2399) | | Computer Information Systems (6612) | |
| SECONDARY | 11 | DE English 11 (1150) or AP English (1196) | Algebra II (3135) Or Algebra Functions and Data Analysis 3134 | AP Chemistry (4470) | AP US/VA History (2319) | | Computer Network Software Operations (6650) | |
| SECONDARY | 12 | DE English 12, (1601) or AP English 12 (1195) | Math Analysis, (3162) or AP Calculus ( 3177, 3178) or AP Probability and Statistics (3190) | AP Physics (4570)(or Principles of Technology I and II (9811, 9812) | AP Government (2445) | | Advanced Computer Network Software Operations (6651) | |
| **High school courses in the pathway offered locally for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**List related certifications/credentials approved by VDOE and offered locally:**
http://www.cteresource.org/apg (Go to Certification - License Section.)

A+ Certification (2006 Objectives), Brainbench Network Administration Certifications, Brainbench Systems Administration Certifications, Brainbench Technical Support Certifications, Certified Internet Webmaster Associate, Certified Novell Administrator (CNA), Computer Networking Fundamentals Assessment, Computer Repair Technology Assessment, Fundamentals of Wireless LANs Examination, IC3Certification, IT Essentials 1 Examination (PC Hardware and Software), IT Essentials 2 Examination (Network Operating Systems), Linux+ Certification, Microsoft Certified Application Specialist (MCAS), Microsoft Certified Professional (any Microsoft Professional Certification exam), Microsoft Office Specialist (MOS), Network+ Certification, UNIX Examination, Virginia Workplace Readiness Assessment and IC3 Certification , Workplace Readiness Skills for the Commonwealth (CTECS)

**Additional Learning Opportunities:**
CTSO Organization(s): ☐ DECA ☒ FBLA ☐ FCCLA ☐ FFA ☐ FEA ☐ HOSA ☐ SkillsUSA ☐ TSA

**Work-Based Learning:**
☒ Career Research ☒ Cooperative Education ☒ Internship ☒ Mentorship
☒ Job Shadowing ☒ Service Learning Project ☐ Student Apprenticeship

**Postsecondary**: Placement Assessments such as Virginia Placement Test or COMPASS

College Entrance Exams such as ACT & SAT

| POSTSECONDARY | SAMPLE POSTSECONDARY PROGRAMS RELATED TO THIS CAREER PATHWAY<br>Individual plans must include locally agreed upon courses at the postsecondary level (See page 2) | | | |
|---|---|---|---|---|
| | **Pathway** | **Associate Degree, College Certificate, or Apprenticeship** | **Bachelors Degree** | **Postgraduate Degree** |
| | Network Systems | Computer Science – AS (Transfer)<br>Information Technology – AS (Transfer) | Locally Determined | Locally Determined |



**College:** New River Community College **School Division(s):** Montgomery County

**Postsecondary**: Placement Assessments such as Virginia Placement Test or COMPASS

POSTSECONDARY - COMMUNITY COLLEGE or APPRENTICESHIP - Determined Locally

| Semester | English | Mathematics | Science | Social Studies | Required Courses or Recommended Electives | | | |
|---|---|---|---|---|---|---|---|---|
| **POSTSECONDARY PLAN OF STUDIES MUST INCLUDE POSTSECONDARY ACADEMIC, CTE, AND OTHER ELECTIVE COURSES APPROPRIATE FOR AN ASSOCIATE DEGREE.** | | | | | | | | |
| Year 1 1st Semester | Eng 111 College Composition I | MTH____ | | HIS 111 History of World Civilization I (or HIS 121 or HIS 101) | CSC 110 Introduction to Computing (DE6612) | CSC 200 Introduction to Computer Science | SDV 100 College Success Skills | |
| Year 1 2nd Semester | ENG 112 College Composition II | MTH _____ | | HIS 112 History of World Civilization II (or HIS 122 or HIS 102) | CSC 205 Computer Organization (or IT elective) | Humanities or Fine Arts Elective | | |
| Year 2 1st Semester | ENG 241 | | Natural I Science with lab | Social Science elective | CSC 201 Computer Science I | Health or Physical Education | | |
| Year 2 2nd Semester | | | Natural Science II with lab | Social Science elective | CSC 202 Computer Science | CST 100 Principles of Public Speaking | | |
| **College courses offered locally in the high school for college credit should be coded: DE (Dual Enrollment) and/or VC (Validated Credit)** | | | | | | | | |

**Related Industry Certifications Available:**

**Additional Suggested Learning Opportunities:**

**Work-Based Learning:**

☐ Cooperative Education ☐ Internship ☐ Mentorship
☐ Job Shadowing ☐ Service Learning Project ☐ Registered Apprenticeship

| UNIVERSITY | University/College: Radford University<br>Degree or Major: Computer Science and Technology, Computer Science or Networks concentration<br>Number of Articulated CC Credits: 62 |
| --- | --- |
| Notes: | |

# APPENDIX N

# Certificate of Insurance

# CERTIFICATE OF INSURANCE

ISSUE DATE 04/18/2013

**PRODUCER**

Vaco Risk Management Programs
308 Market St., SE
Suite 1 & 2
Roanoke, VA 24011-

THIS CERTIFICATE OF INSURANCE IS ISSUED AS A MATTER OF INFORMATION ONLY. IT CONFERS NO RIGHTS UPON THE THIRD PARTY REQUESTING THE CERTIFICATE BEYOND WHAT THE REFERENCED POLICY OF INSURANCE EXPRESSLY PROVIDES. THIS CERTIFICATE OF INSURANCE DOES NOT EXTEND, AMEND, OR ALTER THE COVERAGE, TERMS, EXCLUSIONS, OR CONDITIONS AFFORDED BY THE POLICY REFERENCED IN THIS CERTIFICATE OF INSURANCE.

## COMPANIES AFFORDING COVERAGE

COMPANY LETTER A Virginia Association of Counties Group Self-Insurance Risk Pool

COMPANY LETTER B

COMPANY LETTER C

COMPANY LETTER D

COMPANY LETTER E

**INSURED**

Montgomery County Public Schools
750 Imperial Street, SE
Christiansburg, VA 24073

**COVERAGES**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED, NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

| CO LTR | TYPE OF INSURANCE | POLICY NUMBER | POLICY EFFECTIVE DATE (MM/DD/YY) | POLICY EXPIRATION DATE (MM/DD/YY) | LIMITS | |
|---|---|---|---|---|---|---|
| A | GENERAL LIABILITY | VA-MO-060B-13 | 07/01/2012 | 07/01/2013 | GENERAL | $ 5,000,000 |
| | X COMMERCIAL GENERAL LIABILITY | | | | PRODUCTS-COMP/OP | $ 5,000,000 |
| | CLAIMS MADE X OCCUR | | | | PERSONAL & ADV. INJURY | $ 5,000,000 |
| | OWNER'S & CONTRACTOR'S PROT. | | | | EACH OCCURRENCE | $ 5,000,000 |
| | X 0 RETENTION | | | | FIRE DAMAGE (Any one fire) | $ 500,000 |
| | | | | | MED. EXPENSE (Any one person) | $ 5,000 |
| A | AUTOMOBILE LIABILITY | VA-MO-060B-13 | 07/01/2012 | 07/01/2013 | COMBINED SINGLE LIMIT | $ 5,000,000 |
| | X ANY AUTO | | | | BODILY INJURY (Per person) | $ |
| | ALL OWNED AUTOS | | | | BODILY INJURY (Per accident) | $ |
| | SCHEDULED AUTOS | | | | | |
| | HIRED AUTOS | | | | PROPERTY DAMAGE | $ |
| | NON-OWNED AUTOS | | | | | |
| | GARAGE LIABILITY | | | | | |
| | X 0 RETENTION | | | | | |
| | EXCESS LIABILITY | | | | EACH OCCURRENCE | $ |
| | UMBRELLA FORM | | | | AGGREGATE | $ |
| | OTHER THAN UMBRELLA FORM | | | | | |
| A | OTHER | | | | | |
| | Property | VA-MO-060B-13 | 07/01/2012 | 07/01/2013 | $1,000 Ded/Blanket per schedule on file | |
| | Auto Physical Damage | VA-MO-060B-13 | 07/01/2012 | 07/01/2013 | $250 Comprehensive $ 250 Collision | |
| | Crime | VA-MO-060B-13 | 07/01/2012 | 07/01/2013 | $500,000 Blanket, $250 Deductible | |
| | School Leaders | VA-MO-060B-13 | 07/01/2012 | 07/01/2013 | $2,500 Ded $ 5,000,000 Limit | |

**DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/SPECIAL ITEMS**

RE: adding a STEM academy to be located at Christiansburg High School.

**CERTIFICATE HOLDER**

Virginia Department of Education
Office of Career & Technical Ed Services
Attn: George R. Willcox
PO Box 2120
Richmond, VA 23218

**AUTHORIZED REPRESENTATIVE**

Carol Jordan

## APPENDIX O

## Montgomery County STEM Academy
## Budget

| A-Director Costs | State Funds | Perkins Funds | Other Funds (Local or grant funds to be described in Budget Narrative) | In-Kind | Rationale |
|---|---|---|---|---|---|
| 1. Personnel - 1000 | $0.00 | $0.00 | $0.00 | $173,888.00 | Employ 4 full-time teachers to teach the advanced manufacturing skillsets of Drafting, Pre-Engineering, Precision Machining, Welding, Information Technology, and Computer Programming ( 4 X $43,472 avg salary + 173888.) |
| 2. Employment Benefits - 2000 | $0.00 | $0.00 | $0.00 | $13,302.00 | 7.65% of salary |
| 3. Purchased/Contractual Services - 3000 | $0.00 | $0.00 | $2,700.00 | $0.00 | webpage and graphics development $1500, 12 posters to advertise the program and website $300, 1500 flyers for parents to distribute at parent nights and send home through students $900 |
| 5. Staff Development - 5000 | $0.00 | $200.00 | $2,300.00 | $0.00 | Subs for 4 Academy teachers plus 8 articulating core teachers ($77 per day + 7.65% benefits = 82.9 X 4+ $332) ,2- full day workshops with working lunch $ 234, Presenter honorarium for 3D printer curriculum $500, binders & handouts $100 |
| 7. Travel - 5000 | $0.00 | $3,200.00 | $0.00 | $0.00 | Travel for 4 Academy teachers to attend State CTE Conference ($200 registration, $500 room & board, $100 mileage X 4 teachers = $3200) |
| 9. Materials and Supplies - 6000 | $0.00 | $17,598.00 | $0.00 | $0.00 | Makerbot Kits 2@ $5,598, Lego Mindstorms kits $12,000 |
| 10. Equipment - 8000 | $0.00 | $6,400.00 | $0.00 | $40,000.00 | 3D printer $40,000, plotters x 2 @$6,400 |
| | | | | | |
| B-Indirect Costs* | | | | | |
| **TOTAL** | $0.00 | $27,398.00 | $5,000.00 | $227,190.00 | |

*If recovering indirect costs, the rate must not exceed the federally approved indirect cost rate of the fiscal agent.