Virginia Board of Education Agenda Item

Agenda Item: B **Date:** June 27, 2013

Title	Final Review of Proposals to Establish the following Governor's STEM Academies: 1) Fairfax County Public Schools Governor's STEM Academy at George C. Marshall High School; 2) Harrisonburg City Public Schools Governor's STEM Academy at Harrisonburg High School; and 3) Montgomery County Public Schools Governor's STEM Academy at Christiansburg High School		
Presenter	Ms. Lolita B. Hall, Director, Office of Career and Technical Education Services Jeff McFarland, Academy Coordinator, Marshall High School, Fairfax County Public Schools J. Patrick Lintner, Executive Director for Instruction, Harrisonburg City Public School Rick Weaver, Career and Technical Education Supervisor, Montgomery County High School		
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Purpose of Presentation:
Other initiative or requirement. Specify below:
Final review of proposals to establish the following Governor's STEM Academies:
1) Fairfax County Public Schools Governor's STEM Academy at George C. Marshall High School
2) Harrisonburg City Public Schools Governor's STEM Academy at Harrisonburg High School; and
3) Montgomery County Public Schools Governor's STEM Academy at Christiansburg High School

Previous Review or Action:
Previous review and action. Specify date and action taken below:
Date: May 23, 2013
Action: First Review

Action Requested:
Final Review: Action requested at this meeting

Alignment with Board of Education Goals: Please indicate (X) all that apply:

X	Goal 1: Accountability for Student Learning
	Goal 2: Rigorous Standards to Promote College and Career Readiness
X	Goal 3: Expanded Opportunities to Learn
	Goal 4: Nurturing Young Learners
	Goal 5: Highly Qualified and Effective Educators
	Goal 6: Sound Policies for Student Success
	Goal 7: Safe and Secure Schools
	Other Priority or Initiative. Specify:

Background Information and Statutory Authority:
Goal 1: The Academy must meet rigorous criteria established by the Board of Education. Students progress in academic and technical knowledge and skills; and their employability knowledge and skills are monitored and measured annually to ensure successful transition to college and career.

Goal 3: The Governor's STEM Academy is designed to expand opportunities for the general student population to acquire STEM literacy and other critical skills, knowledge, and credentials that will prepare them for high-demand, high-wage and high-skill careers.

Partnerships establishing academies must include at least one public school division, business and industry, and postsecondary education. On November 29, 2007, the Board of Education approved the criteria to establish a Governor's STEM Academy. Subsequently, on March 19, 2008, the Board approved the standards for the Governor's Career and Technical Education Exemplary Standards Awards Program, which all Career and Technical Academies must implement.

The State Council of Higher Education for Virginia (SCHEV) has reviewed the proposals and recommends approval by the Board of Education. Staff members of the Virginia Department of Education (VDOE) have reviewed the proposals in the context of the established criteria. An executive summary of the proposals is in Attachment A.

Currently, there are 19 Governor's STEM Academies in Virginia. They are located in Arlington County, Carroll County, Chesapeake City, Chesterfield County, Fairfax County, Halifax County, Hampton City, Loudoun County, Lynchburg City, New Kent County, Newport News City, Pulaski County, Richmond City, Richmond County, Roanoke County, Russell County, Stafford County, Suffolk City, and Virginia Beach City.

Summary of Important Issues:
1) Proposal to Establish the Fairfax County Public Schools Governor's STEM Academy at George C. Marshall High School

Marshall High School Governor's STEM Academy in collaboration with its partners: Fairfax County Public Schools, Systemic Solutions, George Mason University, Virginia Tech, Positek.net LLC, Tysons Regional Chamber of Commerce, Junior Achievement of Greater Washington, Marymount University, TerraWi, Cisco Systems, and Watnee LLC, will provide students the foundational skills needed to pursue career pathways within information technology and engineering. The Academy is centrally located within Northern Virginia's Tysons Corner and twelve miles west of the District of Columbia. Because of its central location, partnerships with local businesses, post secondary articulation and dual enrollment agreements, the Governor's STEM Academy will be uniquely poised to meet the mission: increase student access to STEM specific instructional programs and pathways in career and technical education; and develop a highly-skilled, diverse STEM high school graduate prepared for postsecondary education or the global workforce. The Academy will have the capacity to enroll 400 students, grades 9-12. During the 2013-14 school year 150 students will be admitted.

The Academy will focus on the following two career pathways within two career clusters:

CAREER CLUSTER	CAREER PATHWAY
Information Technology	Network Systems
Science, Technology, Engineering, and Mathematics (STEM)	Engineering and Technology

Students enrolled in the Network Systems pathway will learn about the design, development and management of different types of software programs and hardware. This field requires a rigorous foundation in mathematics and science as well as high technical skills. The study of cyber security is an emerging field with many career possibilities. Digital defense is not only for those working in technology, government, or law enforcement jobs. Cybersecurity affects any business or organization that uses internal computer systems or connects to the Internet to do business, including those in: homeland security, public and private cyber monitoring, health care information protection, energy industry systems protection, banking, education, online retail, product development, and technology products and services. The coursework will focus on systems, networks, and technology. Students will gain specific cybersecurity skills in the ethics and legal issues related to data gathering and protection; engage in real-world plans and processes for common security scenarios, techniques and technologies that protect data and systems; and will learn about ways to detect and defend against cyber attacks.

The Information Technology (IT) lab will include 32 data drops and wireless connectivity for computer workstations, mobile devices, and laser printers. It will be fully equipped for interactive teleconferencing. Students will study collegiate-level software applications such as Microsoft's Network Administration and Security, Cisco CCNA and Healthcare, Oracle, and A+ computer systems technology to optimize interaction, critical thinking, and problem-solving capabilities in the IT field. The lab has two primary zones that allow independent study and group sessions to occur simultaneously. The *Cyber Center* encourages hands-on applications in a virtual lab environment to increase students' ability to reduce vulnerabilities in today's computer network systems. In the *Networking Center,* students will have the appropriate equipment to develop flexible network configurations.

As technology advances across the globe, it is important to have individuals who understand and can support the new technological demands. Network Systems and Data Communications Analysts are predicted to see a 53 percent increase in employment opportunities.

Students enrolled in the Engineering and Technology pathway will engage in rigorous problem-solving experiences. They will learn how to use their knowledge of science, mathematics, logic, and economics to find suitable solutions to real-world problems. The STEM lab will be equipped for 21st century learning. The lab will offer collegiate-level applications and sophisticated technologies to optimize research, interaction, and critical thinking among the students. The lab will have two primary zones that allow independent study and group sessions to occur simultaneously. The *Think Tank* will encourage students to think out loud and it will be equipped to support global conferencing. In the *Lab Zone* students will have appropriate equipment for the flexibility to conduct many experiments. An overhead gridding system and large tabletops will allow for optimal connections to equipment, while speakers and microphones transmit throughout the lab. Additional equipment will include a wind tunnel, Computer Numerical Control (CNC) machines, 3D prototype printer, large format printer, plasma cutter, and computer workstations with computer-aided design (CAD) software.

Over the next decade, jobs aligned with advancing technology are predicted to boom as new career opportunities open. Individuals with college degrees and experience working with high-tech laboratory equipment have the most potential for success within this industry.

2) <u>Proposal to Establish the Harrisonburg City Public Schools Governor's STEM Academy at Harrisonburg High School</u>

As the world and Virginia are changing rapidly, it is predicted that areas such as health, energy, environment, and natural resources will have serious personal, social, and global issues for current and future populations to solve. Outside the typically educational setting, science, technology, engineering, and mathematics (STEM) are integrated naturally to study and solve problems. The proposed Harrisonburg High School Governor's STEM Academy emphasizes an integrative (I-STEM) learning approach to prepare students for meeting the challenges of today and the near future. The I-STEM model consists of specific units that are collaboratively developed based on the Science Standards of Learning and integrated with those from language arts, mathematics, social science, technology as well as engineering content.

Harrisonburg City Public Schools (HCPS) provides all students in all five elementary schools and both middle schools with daily science and mathematics education including units designed as integrative lessons in I-STEM. By creating a Governor's STEM Academy, HCPS expects to raise student aspirations and attract more students to postsecondary education in preparation for the career pathways of Engineering and Technology, and Science and Mathematics. The Academy will have the capacity to enroll 296 students, grades 9-12. During the 2013-14 school year 98 students will be admitted.

The Academy will focus on the following two career pathways within the STEM career clusters:

CAREER CLUSTER	CAREER PATHWAY
Science, Technology, Engineering, and Mathematics (STEM)	Engineering and Technology
	Science and Mathematics

In the seventh and eighth grades, students have an opportunity to participate in the Middle School STEM Exploration Academy, where they integrate career and technical education courses with science courses and explore different career options based on their interests. Whether students choose to apply to and enter the Harrisonburg High School Governor's STEM Academy in either of the two pathways, they will have access to Advanced Placement and dual enrollment science and mathematics courses as well as the opportunity to receive postsecondary certificates including the Governor's certificate of recognition for the Early College Scholars Program. Students entering engineering and technology pathways will be completers in Engineering Studies. Coursework will be enhanced through integration with physics, algebra II, Earth Science, chemistry, and English. Students in both pathways will take science and mathematics courses their junior and senior years, including several Advanced Placement and dual enrollment courses with the opportunity for mentorships or internships with Academy's higher education and/or business partners that include: James Madison University, Blue Ridge Community College, Blackwell Engineering, Rockingham Group, Shenandoah Valley Electric Cooperative, Serco, Kawneer, Shenandoah Valley Technology Counsel, and Stanford Research Institute.

Students in the Academy will be immersed in problem and project-based learning in grades nine through twelve. Students in both pathways are required to participate in extracurricular activities including, but are not limited to the Academic Competition Team, Bib Blue 'Botics (HHS FIRST Robotics team), Environthon, and attendance at local science and mathematics lectures.

According to the Virginia Workforce Connection, as of September 10, 2012, there were 14,200 unfilled professional, scientific, and technical services jobs in Virginia. Graduates seeking well-paying careers need not search fare if their skill sets are a match for the opportunities. In

Harrisonburg and neighboring Rockingham County, there are many science and technology-oriented businesses and industries looking to hire talented, well-educated workers. The positions available include those requiring some college and experience as well as those requiring engineering associates degrees, Masters of Engineering, and Doctorates.

Students graduating from the Harrisonburg High School Governor's STEM Academy will have a strong academic preparation for entering a four-year college majoring in a wide variety of STEM fields. They will be well-prepared to continue education in any of Virginia's high-demand fields of economic growth as identified by the Virginia Economic Development Partnership, including: food processing, clean energy, biotechnology research and development, federal security agencies and providers, information technology, aerospace, and global logistics.

3) Proposal to Establish the Montgomery County Public Schools Governor's STEM Academy at Christiansburg High School

The proposed Montgomery County Public Schools Governor's STEM Academy will be located at Christiansburg High School; however, some of the Academy courses will be offered at the division's other three high schools 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. The Academy will have the capacity to to enroll 150 students, grades 9-12. During the 2013-14 school year 65 students will be admitted.

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 jog openings in the New River Community College Region (see Appendix B). Montgomery County is the largest county served by the New River Community College. Jobs related to STEM, manufacturing, and information technology career clusters are in the top ten occupation groups represented by jobs advertised in the same region. The Montgomery County Governor's STEM Academy in collaboration with its partners: 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, and NRV Competitiveness Center, will offer a program of study to expand students knowledge and skills in STEM literacy as it relates to advanced manufacturing. Students will gain the knowledge and skills needed to succeed in the technologically-rich workplace by learning how to work in teams, communicate effectively, and apply the principles and skill sets in STEM fields. A FIRST Robotics design and build team project will be the co-curricular component for all six pathways in the following chart. This project will be scheduled as an after school course to allow students from all pathways to participate.

The Academy will focus on the following six career pathways within three career clusters will prepare students for programs leading to bachelor's degrees, tow-year associate's degrees, Virginia Community College System diplomas and certificates, apprenticeships, and employment.

CAREER CLUSTER	CAREER PATHWAY
Science, Technology, Engineering, and Mathematics (STEM)	Engineering and Technology
Manufacturing	Manufacturing Production Process Development
	Production

Information Technology	Programming and Software Development
	Information Support and Services
	Network Systems

The FIRST Robotics program is built around a series of year-long elective courses taught by teachers from career and technical education (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 content while university students apply their engineering skills as mentors.

During the 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 path.

The pathways will have clear postsecondary objectives outlined 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.

In summary, the Governor's STEM Academy will provide awareness and opportunity for students and will increase the number of well-trained workers in areas that have been designated as high demand and high tech in business and industry. Offering parallel pathways with multiple post-graduation objectives will help students choose the best path before high school graduation.

Impact on Fiscal and Human Resources:
Funding for implementation must be provided at the local level.

Timetable for Further Review/Action:
The proposed beginning date is school year 2013-14 for the following:
1) Proposal to Establish the Fairfax County Public Schools Governor's STEM Academy at George C. Marshall High School
2) Proposal to Establish the Harrisonburg City Public Schools Governor's STEM Academy at Harrisonburg High School
3) Proposal to Establish the Montgomery County Public Schools Governor's STEM Academy at Christiansburg High School

Superintendent's Recommendation:
The Superintendent of Public Instruction recommends that the Board of Education approve the proposals to establish the following Governor's STEM Academies:
1) Fairfax County Public Schools Governor's STEM Academy at George C. Marshall High School
2) Harrisonburg City Public Schools Governor's STEM Academy at Harrisonburg High School
3) Montgomery County Public Schools Governor's STEM Academy at Christiansburg High School

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 CTE Supervisor Montgomery County High School 750 Imperial Street, SE Phone: 540 382-5100 Ext. 1048 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 Information Support and Services Manufacturing Production Process Development Network Systems Production 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. The following program objectives and performance measures have been established by the Planning/Advisory Committee: • Increase the percentage of Governor's STEM Academy students taking Algebra II by <u>four percent over the next four years.</u> • 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>. • 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

The State Council of Higher Education for Virginia

Review of Governor's STEM Academy Proposal

Name of Lead Entity on Proposal: *Montgomery County Public Schools*

Date of Review: June 5, 2013

The State Council of Higher Education for Virginia recommends approval of: *Governor's STEM Academy at the Christiansburg High School*

Peter Blake
Director

6/7/13
Date

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: .				

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

	Documentation			Comments
	Full	Partial	None	
	X			
Comments: .				

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: 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

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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.
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- 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
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Name of Partner Organization: Montgomery County, VA Economic Development

Signature: Brian Hamilton

Title: Director

Date: 07/19/2013

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Name of Partner Organization: New River Community College

Signature: (Dan A. Lodge)

Title: Dean Business and Technologies

Date: 2/19/13

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Name of Partner Organization: New River Community College

Signature: Deborah D Kennedy

Title: Enrollment Management & Career Pathways Coordinator

Date: 2/19/13

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Name of Partner Organization: Jeld-Wen Interior Doors

Signature: George Wilkins

Title: General Manager

Date: 2/19/13

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Name of Partner Organization: OWPR, Inc.

Signature: JD Price

Title: Vice President, OWPR

Date: 2-19-13

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Name of Partner Organization: Moog Components Group

Signature: William J Roberts Jeff Roberts

Title: Production Manager

Date: 2/19/13

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Name of Partner Organization: Virginia Tech – Integrative STEM Education

Signature: John Wells

Title: Associate Professor/Program Leader

Date: 2-19-2013

MOU?

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Name of Partner Organization: ICAT at Virginia Tech

Signature: Liesl Baum

Title: ~~[illegible]~~ Research Faculty

Date: 2.19.13

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Name of Partner Organization: Virginia Tech (ME Department)

Signature: Linda Vick Linda Vick

Title: Instructor / Academic & Career Advisor

Date: 2/19/13

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

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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
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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
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Montgomery County Public Schools Governor's STEM Academy Partners

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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 28) Copy of program certification by industry, if applicable Teacher's credentials: 29) Copy of industry certification(s) or comparable credentials 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: 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. ▪ volunteers ▪ parents ▪ guest speakers ▪ field trips ▪ judges for CTSO events ▪ industry tours ▪ 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: 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 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: 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

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

Career Cluster	Career Pathway	Governor's STEM Academy Courses *DE indicates a course that is dual enrolled for college credit	Completer Sequences *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 **8433** Materials and Processes **8439** Precision Machining I **8540** Precision Machining II, DE **8541** Precision Machining III **8425** Manufacturing Technology **8433** Materials and Processes	**Precision Machining** **8439** Precision Machining I **DE8540** Precision Machining II	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

Career Cluster	Career Pathway	Governor's STEM Academy Courses *DE indicates a course that is dual enrolled for college credit	Completer Sequences *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 **8433** Materials and Processes **8439** Precision Machining I **8540** Precision Machining II, DE **8541** Precision Machining III **8425** Manufacturing Technology **8433** Materials and Processes	**Precision Machining** **8439** Precision Machining I **DE8540** Precision Machining II	Machine Tool Operator, Materials Inspector, Machine Tool Set-up Operator, Mechanical Inspector, Industrial Machinery Mechanic, ,

Career Cluster	Career Pathway	Governor's STEM Academy Courses *DE indicates a course that is dual enrolled for college credit	Completer Sequences *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 **8433** Materials and Processes **8425** Manufacturing Technology **8433** Materials and Processes **89190** Welding I, DE **80191** Welding II, DE	**Welding** **DE89190** Welding I **DE80191** Welding II **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 *DE indicates a course that is dual enrolled for college credit	Completer Sequences *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 **6640** Programming, DE **6641** Advanced Programming **6612** Computer Information **6613** Advanced Computer Information Systems **8621** Computer Maintenance Advanced **8622** Computer Systems Technology I **8623** Computer Systems Technology II **8624** Computer Systems Technology III **6630** Design, Multimedia and Web Technologies, DE **6670** Information Technology Fundamentals Systems, DE	**Computer Programming** **DE6612** Computer Information Systems **6613** Advanced Computer Information Systems **DE6640** Programming, **DE6641** Advanced Programming	Software Applications Architect, Operating Systems Designer/Engineer, Programmer, Game Programmer, Applications Engineer, Modeling and Simulation Programmer Account Manager, Applications Integrator, Data Systems Designer, Database Administrator, Database Analyst, E-Business Specialist, Information Systems Architect, Instructional Designer, Maintenance Technician, Product Support Engineer, Support Engineer, Systems Analyst, Technical Communicator, Testing Engineer

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

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

Career Cluster	Career Pathway	Additional Courses / Capstone Experience
All Academy Clusters	**All Academy Pathways**	**<u>FIRST Robotics</u>** **98281** Robotics I **98282** Robotics II **98283** Robotics III **8216** Internship **9811** Principles of Technology I **9812** Principles of Technology II **8421** Technology of Robotic Design **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 - Agricultural Engineer/Technician - Application Engineer - Architectural Engineer - Automotive Engineer - Biomedical/Biotechnology Engineer - CAD Technician - Chemical Engineer - Civil Engineer - Communications Engineer - Computer Engineer - Computer Hardware Engineer - Computer Programmer - Construction Engineer - Drafter - Electrical/Electronic/Engineering Technician - Electrical Engineer - Geothermal Engineer - Industrial Engineer/Technician - Manufacturing Engineer/Technician - Marine Engineer - Mechanical Engineer - Metallurgist - Mining Engineer - Nuclear Engineer - Petroleum Engineer - Product/Process Engineer - Survey Technician - Systems Engineer - 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 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): Technical Drawing and Design (DE8435, 8436, 8437, 8438), Pre-Calculus (3162), 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 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								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** 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 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): Technical Drawing and Design (DE8435, 8436, 8437, 8438), Pre-Calculus (3162), Multivariate Calculus (3178	Manufacturing Technology (8425) 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 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: Degree or Major: 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 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								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** 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 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) 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

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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: Degree or Major: 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: Degree or Major: 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 ▪ Operating Systems Designer/Engineer ▪ Programmer ▪ Game Programmer ▪ Applications Engineer ▪ 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 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): AP Computer Science (3185) 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 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 Degree or Major: Computer Science and Technology, Computer Science or Networks concentration 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 • Applications Integrator • Call Center Support Representative • Customer Service Representative • Data Systems Designer • Database Administrator • Database Analyst • E-Business Specialist • Help Desk Specialist • Information Systems Architect • Instructional Designer • Maintenance Technician • PC Support Specialist • PC Systems Coordinator • Product Support Engineer • Support Engineer • Systems Analyst • Technical Communicator • 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 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): Advanced Computer Information Systems 6613 AP Computer Science (3185) DE Computer Information Systems (6612) DE Design, Multimedia and Digital Input Technologies (6630) Programming (6640) 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) 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 • 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	
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 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) 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 Degree or Major: Computer Science and Technology, Computer Science or Networks concentration 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 • Information Systems Administrator • Information Systems Operator • Information Technology Engineer • Network Administrator • Network Architect • Network Engineer • Network Manager • Network Operations Analyst • Network Security Analyst • PC Support/User Specialist • Systems Administrator • Technical Support Specialist • 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 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): AP Computer Science (3185) DE Computer Information Systems (6612) Adv Computer Information Systems (6613/6615) 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 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) 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 Degree or Major: Computer Science and Technology, Computer Science or Networks concentration 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.