Vermont Career Technical Education (CTE) Program Critical Proficiencies

Engineering CTE Programs

The Critical Proficiencies identify the essential knowledge, skills, and abilities that VT CTE students need to demonstrate (1) to be program completers, and (2) to be prepared for future learning. Critical proficiencies promote high expectations for all students, and support students' personal, professional, and academic development. At the high school level, VT's Proficiency-Based Graduation Requirements (PBGRs) reflect the critical proficiencies that lead to postsecondary career and college readiness.

For each of the unique program areas which categorize VT's CTE programs, the proficiency template includes:
- Program-Area Descriptions
- Career Ready Practices
- Career Cluster(s) and Pathway(s)
- Anchor Standards
- Program Technical Standards
- Academic Alignment
- CTE Program Elements

Advance CTE Common Career Technical Core - Career Ready Practices
The Common Career Technical Core (CCTC) is a state-led initiative to establish a set of rigorous, high-quality standards for Career Technical Education (CTE). The CCTC includes a set of standards for each Career Cluster® and corresponding Career Pathways that define what students should know and be able to do after completing instruction in a program of study. The CCTC also includes an overarching set of Career Ready Practices that apply to all programs of study. The Career Ready Practices include statements that address the knowledge, skills, and dispositions that are important to becoming career ready.

The Career Ready Practices were developed from a state-led initiative sponsored by the National Association of State Directors of Career Technical Education Consortium (NASDCTEC).

> Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study. (NASDCTEC, 2012)

The Career Ready Practices

- are applicable across all program areas.
- align with the VT Transferable Skills Proficiency-Based Graduation Requirements (PBGRs) and VT Portrait of a Graduate.
- are the *transferable skills* of the Common Career Technical Core and the *portrait* of a VT CTE program completer.

Advance CTE Common Career Technical Core - Career Cluster and Pathway Standards

The Common Career Technical Core is divided into Career Cluster and Pathway standards. Each Career Cluster contains one or more pathways with pathway-specific technical standards. The template shows which CCTC Career Cluster and Pathway standards are relevant to VT CTE programs.

Anchor Standards

The Anchor Standards build upon the Career Ready Practices and show the overarching standards categories which are common across all technical programs within their Career Cluster(s) and Pathway(s). The VT CTE Anchor Standards are derived from and align with the CCTC Anchor Standards.

Program Technical Standards

The Program Technical Standards build on and continue the Anchor Standards with more complexity, rigor, and career specificity. Knowledge and skills are learned and applied within a standards-based CTE program that integrates classroom, laboratory, and work-based instruction. The VT CTE Program Technical Standards are tailored to the unique characteristics and structure of each of the program areas.

Academic Alignment

Each program-area template includes academic alignment with the VT Content-Area Sample Graduation Proficiencies as part of VT's Proficiency-Based Graduation Requirements (PBGRs). These include Common Core State Standards in English Language Arts and Mathematics, Next Generation Science Standards, as well as other adopted national and state academic standards.

CTE Critical Proficiency Template

Critical Proficiency Template:	Attributes:
Program-Area Descriptions	For VT CTE Program Areas
Common Career Technical Core - Career Ready Practices	1. Act as a responsible and contributing citizen and employee. 2. Apply appropriate academic and technical skills. 3. Attend to personal health and financial well-being. 4. Communicate clearly and effectively and with reason. 5. Consider the environmental, social, and economic impacts of decisions. 6. Demonstrate creativity and innovation. 7. Employ valid and reliable research strategies. 8. Utilize critical thinking to make sense of problems and persevere in solving them. 9. Model integrity, ethical leadership, and effective management. 10. Plan education and career paths aligned to personal goals. 11. Use technology to enhance productivity. 12. Work productively in teams while using cultural global competence.
Common Career Technical Core - Career Cluster(s) and Pathway(s)	Relevant to VT CTE Program Areas
Anchor Standards	1. Academics 2. Communication 3. Problem Solving and Critical Thinking 4. Technology 5. Systems (Responsibility and Flexibility) 6. Health and Safety 7. Leadership and Teamwork 8. Ethics and Legal Responsibilities 9. Career Planning and Management 10. Technical Knowledge and Skills (see Program Technical Standards) 11. Demonstration and Application (see CTE Program Elements)
Program Technical Standards	Build on the Anchor Standards with more complexity, rigor, and career specificity

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Critical Proficiency Template:	Attributes:
Academic Alignment	With VT Content-Area Graduation Proficiencies
CTE Program Elements	Demonstration and application: ● Dual Enrollment/Fast Forward Courses ● Industry Recognized Credentials (IRCs) ● Work-Based Learning/Co-op/Apprenticeship ● National Career Technical Student Organizations ● Entrepreneurship ● Portfolio/Personalized Learning Plan

VT Engineering CTE Programs

Students in **Engineering** programs have in-depth, hands-on experiences in engineering theory and concepts; tools, machinery, and equipment; concept development; electrical systems; physics concepts; manufacturing processes; mathematics; the design process; project management; fundamental control systems; product design and development.

The standards in this program area are designed to prepare students for technical training, postsecondary education, and/or entry-level employment in the field of engineering. Students engage in an instructional program that integrates academic and technical preparation, career exploration, and preparation for postsecondary education and/or training. Knowledge and skills are learned and applied within a standards-based CTE program that integrates classroom, laboratory, and work-based instruction.

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Advance CTE Common Career Technical Core - Career Ready Practices

Advance CTE Common Career Technical Core - Career Ready Practices:	Aligned with **VT Transferable Skills** Proficiency-Based Graduation Requirements (PBGRs) and **VT Portrait of a Graduate**
1. Act as a responsible and contributing citizen and employee.	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community, and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
2. Apply appropriate academic and technical skills.	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
3. Attend to personal health and financial well-being.	Career-ready individuals understand the relationship between personal health, workplace performance, and personal well-being; they act on that understanding to regularly practice healthy diet, exercise, and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial wellbeing, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

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Advance CTE Common Career Technical Core - **Career Ready Practices**:	Aligned with **VT Transferable Skills** Proficiency-Based Graduation Requirements (PBGRs) and **VT Portrait of a Graduate**
4. Communicate clearly and effectively and with reason.	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
5. Consider the environmental, social, and economic impacts of decisions.	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment, and the profitability of the organization.
6. Demonstrate creativity and innovation.	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
7. Employ valid and reliable research strategies.	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices, or inform strategies. They use reliable research processes to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

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Advance CTE Common Career Technical Core - **Career Ready Practices**:	Aligned with **VT Transferable Skills** Proficiency-Based Graduation Requirements (PBGRs) and **VT Portrait of a Graduate**
8. Utilize critical thinking to make sense of problems and persevere in solving them.	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
9. Model integrity, ethical leadership, and effective management.	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes, and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals, and organizational culture.
10. Plan education and career paths aligned to personal goals.	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience, and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

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Advance CTE Common Career Technical Core - **Career Ready Practices**:	Aligned with **VT Transferable Skills** Proficiency-Based Graduation Requirements (PBGRs) and **VT Portrait of a Graduate**
11. Use technology to enhance productivity.	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks - personal and organizational - of technology applications, and they take actions to prevent or mitigate these risks.
12. Work productively in teams while using cultural global competence.	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Advance CTE Common Career Technical Core - Science, Technology, Engineering, Mathematics Career Cluster and Pathway Standards

The following Career Cluster and Pathway standards are relevant to VT Engineering CTE programs:	This Career Cluster® is focused on planning, managing and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services, and research and development services.
STEM Career Cluster	1. Apply engineering skills in a project that requires project management, process control, and quality assurance. 2. Use technology to acquire, manipulate, and report data. 3. Describe and follow safety, health, and environmental standards related to science, technology, engineering, and mathematics workplaces. 4. Understand the nature and scope of the STEM Career Cluster and the role of STEM in society and economy. 5. Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in the STEM Pathways. 6. Demonstrate ethical skills needed in a chosen STEM field.

The following Career Cluster and Pathway standards are relevant to VT Engineering CTE programs:	This Career Cluster® is focused on planning, managing and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services, and research and development services.
Engineering and Technology Pathway	1. Use STEM concepts and processes to solve problems involving design and/or production. 2. Display and communicate STEM information. 3. Apply processes and concepts for the use of technological tools in STSM. 4. Apply the elements of the design process. 5. Apply the knowledge learned in STEM to solve problems. 6. Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.
Science and Mathematics Pathway	1. Apply science and mathematics to provide answers and algorithms for engineering and technological activities. 2. Apply science and mathematics concepts to the development of plans, processes, and projects that address real world problems. 3. Analyze the impact that science and mathematics has on society. 4. Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret, and summarize research and statistical data.

VT CTE Program Anchor Standards

Anchor Standards:	Aligned with Advance CTE Common Career Technical Core - Career Cluster Anchor Standards
1. Academics	Achieve additional academic knowledge and skills required to pursue the full-range of career and postsecondary education opportunities.
2. Communication	Acquire and accurately use terminology and information at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

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Anchor Standards:	Aligned with Advance CTE Common Career Technical Core - Career Cluster Anchor Standards
3. Problem Solving and Critical Thinking	Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques.
4. Technology	Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the workplace environment.
5. Systems (Responsibility and Flexibility)	Initiate, and participate in, a range of collaborations to demonstrate behaviors that reflect personal and professional responsibility, flexibility, and respect in the workplace environment and community settings.
6. Health and Safety	Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the workplace environment.
7. Leadership and Teamwork	Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution.
8. Ethics and Legal Responsibilities	Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.
9. Career Planning and Management	Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.
10. Technical Knowledge and Skills (see Program Technical Standards)	Apply essential technical knowledge and skills common to the Career Cluster and Pathway(s), following procedures when carrying out experiments and/or performing technical tasks.
11. Demonstration and Application (see CTE Program Elements)	Demonstrate and apply technical knowledge and skills across a variety of CTE-specific opportunities in classroom, laboratory, and workplace settings.

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VT Engineering CTE Program Technical Standards

Program Technical Standards: Aligned with Project Lead the Way (PLTW) Engineering Design and Development - for programs choosing to use these standards	Standards for each career path build on and continue the Anchor Standards with more complexity, rigor, and career specificity.
1. Academic and Technical Foundations	a. Identify and utilize appropriate tools, machinery, and equipment. b. Explain and demonstrate the sketching process used in concept development. c. Summarize the concepts that are fundamental to the design of electrical systems. d. Describe how the principles of physics (i.e., force, work, rate, power, energy, resistance) relate to mechanical, electrical, and fluid engineering systems. e. Explain manufacturing processes, including the use of tools and equipment, methods of measurement, and quality assurance. f. Apply the principles of mathematics that are fundamental to engineering technology. g. Describe fundamental control system design and devise systems that complete pre- programmed tasks. h. Recognize the impact that the market and production processes have on product design and development. i. Demonstrate the methods of creating written, graphical, and digital portfolios.
2. Communication	a. Effectively communicate and interpret information clearly within and outside the engineering team using verbal, written, and digital methods.
3. Problem Solving and Critical Thinking	a. Employ the design process to analyze and develop effective solutions to problems. b. Design and construct a culminating project effectively using engineering technology.
4. Safety, Health and Environmental	a. Recognize hazards and safety issues and how to avoid or minimize them in the work space.

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Program Technical Standards: Aligned with Project Lead the Way (PLTW) Engineering Design and Development - for programs choosing to use these standards	Standards for each career path build on and continue the Anchor Standards with more complexity, rigor, and career specificity.
	b. Develop a task plan and hazard assessment for a given task and select the appropriate PPE and work methods to safely perform the task**.**
5. Leadership and Teamwork	a. Demonstrate an ability to function independently and collaborative on multidisciplinary teams in engineering.
6. Ethics and Legal Responsibilities	a. Articulate the professional and ethical standards that are required in the field of engineering.
7. Career Development	a. Identify and explore engineering career options and pathways, and research required training and certification processes.

VT Engineering CTE Program - Academic Alignment with VT Content Area Graduation Proficiencies (PBGRs)

Graduation Proficiencies:	**Indicators:**
English Language Arts	High School 1. **Reading**: b, c, d, g 2. **Writing**: a, b, d, e 3. **Writing**: c 4. **Speaking and Listening**: a, b, d 5. **Speaking and Listening**: a, b, d 6. **Language**: a, c, e
Mathematics	High School 1. **Modeling**: a, b, c, d, e, f 2. **Number and Quantity**: c 3. **Algebra**: g, h, k 4. **Functions**: a, b 5. **Geometry**: d, g, h, m, n 6. **Statistics and Probability**: a, c, e
Science	High School

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Graduation Proficiencies:	Indicators:
	1. **Physical Sciences**: Structure/Properties of Matter, Forces, and Interactions: c, e, h, j, k 2. **Physical Sciences**: Energy, Waves, and Electromagnetic Radiation: a, c, d 7. **Earth and Space Sciences**: Earth Systems: k 8. **Engineering, Technology, and Application of Science**: a, b, e, f, i
Global Citizenship/Social Studies	End of Gr. 12 **Inquiry**: Constructing compelling and supporting questions: a, d; Determining helpful sources: a **Civics**: Processes, Rules, and Laws: a **Economics**: Economic Decision Making: a; Exchange and Markets: a **Geography**: Human Environment Interaction: Place, Regions, and Culture: a **Communicating Conclusions and Taking Informed Action**: Communicating: b; Taking Informed Action: a
Arts: Media Arts	High School 1. **Create**: a, b, c 2. **Present**: c, d 3. **Respond**: d 4. **Connect**: d

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VT Engineering CTE Program Elements

Demonstration and Application:	Available Options:
Dual Enrollment/Fast Forward Courses	● **VTC:** Design Communication I (MEC 1011) ● **CCV:** Intro to Business (BUS-1010-VC50), Startup 802: An Entrepreneurial Mindset (BUS-1125-VC50), Intro to Computer Science (CIS-1100-VC50) ● **New Hampshire Technical Institute:** Digital Fundamentals (ELET 115C), Engineering Design (MCET 105C), Computer Integrated Manufacturing (MFET 241C) ● **River Valley Community College:** Machine Processes 1 (MTTN 106R), Computer Numerical Control 1 (MTTN 101 R)
Industry Recognized Credentials (IRCs)	**Tier 1:** ● Career Safe ● Conover Workplace Readiness ● OSHA 10 **Tier 2:** ● Certiport - Autodesk AutoCAD ● Certiport - Autodesk Fusion 360 ● Certiport - Autodesk Inventor ● Certiport - Autodesk 3DS MAX ● Certiport - Autodesk Maya ● Certiport - Autodesk Revit ● SOLIDWORKS - Certified SOLIDWORKS Associate (CSWA) ● SOLIDWORKS - Certified SOLIDWORKS Professional (CSWP) ● ACT National Career Readiness Certificate - Levels 5, 6, or 7
National Career Technical Student Organizations (CTSOs)	SkillsUSA
Work-Based Learning/Co-op (WBL)	Varies by CTE Center
Entrepreneurship Opportunities	Varies by CTE Center
Portfolio/Personalized Learning Plan (PLP)	Varies by CTE Center

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