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CTSO Course Alignments: Principles of Engineering and Technology

Below you will find standards for the Principles of Engineering and Technology course aligned with competitive events from appropriate career and technical student organizations (CTSOs). Knowing the aligned events for your organization will allow you to have additional tools for teaching course standards, as well as increase student engagement and preparation in your CTSO activities. The final column recommends potential tools from other CTSO organizations. Even if your students are not participating in these organizations, available rubrics, tools, and materials can also add to the instructional resources at your disposal for best teaching your content.

Important to note: While the aligned activities below can be important tools in teaching course standards, it is important to note that events may not cover a standard in its entirety and should not be the sole instructional strategy used to address a standard.

	STANDARD	ALIGNED TSA COMPETITIVE EVENTS/PROGRAMS	OTHER POTENTIAL CTSO TOOLS & RESOURCES
1	Accurately read and interpret safety rules, including but not limited to rules published by the National Science Teachers Association (NSTA), rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between the rules and explain why certain rules apply. (TN Reading 3, 4, 6)		• **SkillsUSA**: Occupational Health and Safety
2	Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment. Incorporate safety procedures and complete safety test with 100 percent accuracy. (TN Reading 3, 4)		• **SkillsUSA**: Occupational Health and Safety
3	Research the definition of each term within STEM: Science, Technology, Engineering, and Mathematics. Use these definitions and additional print and electronic resources (such as textbooks, National Science Teacher Association's STEM Classroom newsletters, or the websites of organizations like *STEM Connector*) to develop a written argument describing why science, mathematics, and technology are different than engineering, yet each influences engineering. Incorporate proper citation conventions used in STEM fields (MLA, APA, or other) to cite sources of information retrieved. (TN Reading 1, 5; TN Writing 2, 9)	• **TSA** Essays on Technology	• **HOSA**: Researched Persuasive Speaking

4	In teams, produce a timeline or infographic illustrating important events in history, in a given time period, that specifically involve engineering. Use a variety of sources to gather data, cite each source, and briefly describe why the chosen source is reliable. (TN Reading 1, 8; TN Writing 2, 8)	• **TSA** Desktop Publishing, Promotional Graphics	• **HOSA**: Extemporaneous Health Poster
5	As a team, develop a written explanation of how society benefits from the contributions of engineers in at least three different engineering disciplines. Provide detailed descriptions of each discipline and describe the specific benefits derived from each. For example, describe how civil engineers improve the efficiency and safety of transportation networks through the construction of bridges, highways, and other public infrastructures. Documents should contain links to relevant websites to illustrate the ideas presented. (TN Reading 1, 2; TN Writing 2, 6, 7, 8)	• **TSA** Career Preparation	• **DECA:** Professional Selling Events • **FCCLA**: Advocacy • **HOSA**: Job Seeking Skills
6	There are different versions of the engineering design process. For example, examine the following framework endorsed by the International Technology and Engineering Educators Association (ITEEA): a. Identify the problem b. Identify criteria and specify constraints c. Brainstorm possible solutions d. Research and generate ideas e. Explore alternative solutions f. Select an approach g. Write a design proposal h. Develop a model or prototype i. Test and evaluate j. Refine and improve k. Create or make a product l. Communicate results Citing this framework or other variations as approved by the instructor, compare and contrast what is involved at each step of the engineering design process. Explain why it is an iterative process and always involves refinement. (TN Reading 3, 4, 5; TN Writing 2, 4, 9)		
7	In teams, evaluate an existing large-scale engineering design using the engineering design process. Produce a report on the chosen design, and assume the role of the engineering design team that produced the design. Document constraints that may have been faced by the design team, criteria for measuring the effectiveness of the design, and progress through each step of the engineering design process. Create and deliver a presentation appropriate for a career and technical student organization (CTSO) event. (TN Reading 3, 4, 5, 7; TN Writing 2, 4, 9)		

8	Complete a simple design activity and apply the engineering design process to produce a model that an engineer would test. Define criteria for determining an effective design, describe constraints on the design, and document each step in an engineering notebook. At the completion of the design process, present the model to the class and critique the design of other classmates. (TN Reading 3, 4, 5, 7, 9; TN Writing 4, 7)		• **FBLA:** 3-D Animation, Database Design, Computer Game & Simulation
9	Define the differences in technique among freehand sketching, manual drafting, and computer-aided drafting (CAD), and describe the skills required for each. Create a two-dimensional orthographic (multiview) drawing incorporating labels, notes, and dimensions, using sketching/geometric construction techniques. Apply basic dimensioning rules and properly use different types of lines (e.g., object, hidden, center). The orthographic projections should include principle views of a simple object from top, front, and right sides. (TN Reading 3, 4, 5, 7; TN Writing 4; TN Math G-MG)	• **TSA** Computer-Aided Design (CAD) 2D, Architecture, Computer-Aided Design (CAD) 3D, Engineering, Technical Sketching and Application	• **SkillsUSA**: Architectural Drafting, Technical Drafting
10	Building on the knowledge of a two-dimensional drawing, create simple isometric (3-D pictorial) drawings, properly using lines (e.g., object, hidden, center), labels, and dimensioning techniques. (TN Reading 3, 4, 5, 7; TN Writing 4; TN Math G-MG)	• **TSA** Computer-Aided Design (CAD) 3D, Engineering, Technical Sketching and Application	
11	Use CAD software to create simple two-dimensional and three-dimensional drawings, accurately incorporating labels, notes, dimensioning, and line types to design drawings. Perform basic operations such as creating, saving files, opening files, storing files, and printing. (TN Reading 3, 4, 5, 7; TN Writing 4; TN Math G-MG)	• **TSA** Computer-Aided Design (CAD) 2D, Architecture, Computer-Aided Design (CAD) 3D, Engineering	• **FBLA:** 3-D Animation • **SkillsUSA**: Architectural Drafting, Technical Drafting
12	Use physical measurement devices typically employed in engineering to collect and build a dataset. For example, calipers may be used to measure the width of pens in the classroom, generating a dataset. Tools should include, but are not limited to, fractional rule, metric rule, dial caliper, and micrometer. (TN Reading 1, 3, 7; TN Writing 4; TN Math N-Q)		

13	As a class, identify a problem in the school or community that can be solved by an engineer. Follow the design process to solve the problem. The class will collaboratively develop a paper following the format of a typical technical report (see components of the report below). Upon completion of the report, create and deliver a presentation for a CTSO event using appropriate citation conventions learned in the course. Refine the report as would a team of engineers by incorporating feedback from the presentation. The technical report should include, but is not limited to: a) Background b) Problem definition c) Design constraints d) Methodology e) Data analysis (e.g., charts, graphs, calculations) f) Results/Problem solution (including engineering drawings) g) Conclusions and recommendations for future research (TN Reading 1, 3, 4, 5, 7, 9; TN Writing 2, 5, 6, 7, 8, 9, 10)	• **TSA** Technology Problem Solving	• **FCCLA**: Advocacy
ALL	**CAN BE USED WITH ALL/MOST STANDARDS**	• **TSA** Engineering Design	• **FCCLA**: Illustrated Talk, Career Investigation, Chapter in Review Display, Chapter in Review Portfolio, • **SkillsUSA**: Career Pathways Showcase, Job Skills Demonstration A, Job Skills Demonstration O, Prepared Speech, Extemporaneous Speaking, Chapter Display, Principles of Engineering Technology, Engineering Technology/Design