CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Architecture & Construction

Learning that works for Colorado CTE®

Colorado CTE Course – Scope and Sequence

Course Name	Drafting and Design Technology	Course Details Course = 0.50 Carnegie Unit Credit	Credit = 1.0 CTE Credential= CTE STEM, CTE Architecture and Construction, CTE Manufacturing
Course Description	This class will cover the basic principles of the world of drafting and design and offers students the opportunity to combine design principles with technology to produce authentic projects. Students will explore the many aspects of how drafting and design can be used in architecture, industrial design, engineering, graphic arts and other professions. Students will develop an understanding of the visual elements and the principles of design and follow protocol dictated by drafting and design standards. Students will study both two and three-dimensional applications and problems. Students will use drafting tools to create drawings of preliminary sketches, orthographic projections, isometric, floor plans, and many others. Emphasis will be placed on paying close attention to detail such as line quality, neatness, correct use of tools and accuracy. All students are required to read and use a scale for measuring. After the design phase, students will be expected to use their plans to select items to produce.		
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.		
SCED Identification #	21102	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.	

All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at **https://www.cde.state.co.us/standardsandinstruction/essentialskills**

Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Career Exploration		Develop an education and career plan aligned with personal goals.	Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. Student is expected to:	Research the postsecondary institutions (colleges of applied technology, community colleges, and four-year universities) in Colorado and other states that offer architecture or engineering design programs. Write an informative paper or develop an	Updates to ICAP SkillsUSA Technical Drawing

			(A) identify personal interests, aptitudes, information, and skills necessary for informed career decision making. (B) evaluate personal character traits such as trust, respect, and responsibility and understand the impact they can have on career success. (C) explore how information and communication technologies are used in career planning and decision making. (D) research the scope of career opportunities available and the requirements for education, training, certification, and licensure.	infographic identifying admissions criteria, the postsecondary programs of study, and the secondary courses that will prepare individuals to be successful in a postsecondary architecture or engineering program. Evaluate the tentative career plan developed in the introductory course in light of these findings, and update the career plan to reflect any new discoveries, citing evidence from the research. Evaluate local employment opportunities available for drafting and design occupations. Examine the education, training, and certification requirements for entry-level and for advancement to higher level positions.	
Advanced CADD		Understand and apply various technical drafting and design techniques to develop ideas and concepts.	Use computer-aided drafting and design (CADD) software to create two-dimensional drawings of advancing complexity. Student is expected to: (A) accurately incorporate symbols, notes, dimensioning, and line types to CADD drawings;	perform software operations such as utilizing sheets/layouts for printing, scaling viewports in sheets/layouts for printing, printing drawings to proper scale, outputting drawings to electronic and paper media, and overlaying drawings on externally-referenced drawings. Use CADD software to create accurate multi-view drawings of objects of advancing complexity	

			(B) perform intermediate and/or advanced CADD software operations; (C) use CADD software to create accurate multi-view drawings of objects of advancing complexity; (D) use CADD software to create pictorial drawings of advancing complexity according to industry standards. (E) create accurate sectional view drawings of advancing complexity (such as full, half, offset, broken-out, removed, and revolved sections); (F) create accurate auxiliary view drawings of advancing complexity including depth, height, or width auxiliary views; partial auxiliary views; and auxiliary section views; and (G) draw detailed, schematic, and simplified drawings of various types of threads and fasteners, including unified, square, and acme threads.	using orthographic projection, incorporating symbols, notes, dimensions, and line type (such as hidden lines to show internal or hidden features). Use CADD software to create pictorial drawings of advancing complexity, such as isometric, oblique, and perspective drawings. Attend to detail by using proper angles and ensuring holes, cylinders, prisms, and other features are in proper alignment and relationship to each other. Incorporate symbols, notes, dimensions, and line type according to industry standards. Create accurate sectional view drawings of advancing complexity incorporating symbols, notes, and dimensions, using appropriate layout within title blocks, and appropriate drawing composition (including line weight and line type). For example, create a full section drawing of a mechanical part, hatching appropriate surfaces and using notation to indicate the cutting plane. Demonstrate the ability to accurately interpret industry-standard thread notes to calculate the thread pitch as well as lay out and construct the drawing.	

				In teams, produce a complete set of project drawings including a completed assembly drawing and an exploded assembly drawing. Supplement assembly drawings with appropriate representations of individual components and a bill of materials as needed for the project type. Fully describe the design by selecting the most appropriate drawing type for the given component, including plan, section, and three-dimensional drawings. Demonstrate the ability to refine drawings based on critique from peers, instructors, and self-evaluation. Drawing on evidence from textbooks and other resources, evaluate the effectiveness of a drawing based on industry standards for technical drawing. Interpret and incorporate feedback when refining drawings.	
Dimensioning		Construct projects and products specific to the manufacturing and product design requirements and expectations. Validate that a provided part meets specifications from its engineering drawing by comparing specifications (geometric dimensioning and tolerancing).	Interpret industry standards to accurately apply dimensions, notes, and symbols on CAD drawings. Student is expected to (A) arrange dimensions, using various dimension styles and symbols; (B) adjust annotation styles and sizes based on	Research the American National Standards Institute (ANSI) and describe the goals of the organization and the impact it has on technical drawing, particularly for dimensioning a drawing. Interpret and apply dimensioning rules to accurately label dimensions on drawings including arranging dimensions,	

			the drawing type and scale; (C) define tolerance and give examples of general methods for noting tolerances on drawings; (D) understand the role of the American National Standards Institute (ANSI) on drawing and design industry standards.	using various dimension styles (such as aligned and angular), and avoiding redundancy. Drawing on evidence from textbooks and industry standards (such as the American National Standards Institute and the American Society of Mechanical Engineers), create an infographic an engineer or architect could use as a guide to appropriately employ intermediate/advanced dimensioning rules.	
3D Modeling		Understand and apply various ideation techniques to develop ideas and concepts.	Apply various three-dimensional (3-D) modeling techniques to develop a concept. Student is expected to: (A) use three-dimensional modeling software to create a simple three-dimensional model; and (B) analyze and assess the strengths and weaknesses in the design, function, ergonomics, features, and benefits of a three-dimensional model.	Interpret instructional materials to perform basic operations using three-dimensional modeling software. Instructional materials may include textbooks, instructional manuals, websites, video tutorials, and more. Generate a 3D model for a specific application. Analyze and assess the strengths and weaknesses of the 3D model in terms of the design, function, ergonomics, features, and benefits. Address how well the model meets ANSI standards and identify possible resolutions for improvement.	
Applied Design		Understand how designs are communicated through different types of two-dimensional and three-dimensional drawings,	Produce technical drawings and apply various two-dimensional (2-D) graphic and/or three-dimensional (3-D)	Use technology to create a visual display with supporting text to compare and contrast how different drawing types covered in the coursework are	

		physical models, and virtual three-dimensional models within various disciplines. Understand specifications required for the prototyping or manufacturing of a product.	modeling techniques to develop a concept. Student is expected to: (A) Create a preliminary design of a product concept utilizing CADD software, and/or conceptual model fabrication techniques; (B) identify materials, mechanisms, technologies, and other requirements (e.g., safety, manufacturing, sustainability) the concept may require; (C) interpret technical drawings to build a physical model of a design; (D) interpret symbols and notations within the context of each drawing type; and (E) create drawings of increasingly complex objects and layouts.	implemented in a variety of disciplines, drawing from examples in textbooks, industry journals, drawings created during the coursework, and other resources. For example, illustrate how the plan, orthographic projections, and section drawings of a residence compare with those of a machine part. Create two-dimensional plans for a simple three-dimensional object utilizing drawing techniques learned in the course, such as auxiliary drawing. Use the plans to build a rough study model of the object. Evaluate the model and revise the design on the basis of collected test data. For example, create a two-dimensional drawing of three-dimensional sheet metal design or package design as if the object were unfolded. Print the drawing on paper and construct a paper model of the object. Evaluate the model for inaccuracies and identify opportunities to improve efficiency of materials or construction. Use these conclusions to refine the design. Create an accurate half section drawing of an actual mechanical gear by measuring and examining the physical object in	

				order to visualize and draw the section.	
Troubleshooting		Analyze issues related to drafting and design software processes.	Problem-solve issues related to drafting and design software and/or prototyping. Student is expected to: (A) identify and demonstrate basic troubleshooting strategies related to fundamental hardware and software problems; (B) use electronic media to diagnose and fix hardware and software problems encountered during the coursework.	Consult software forums, tutorial videos, and other instructional materials to diagnose and correct a drawing that prints on paper differently than intended.	
Design Trends		Understand how historical and current design trends and technologies influence the product drafting and design process.	Understand current and historical drafting and designing trends and technological advances. Understand and apply research methodologies as a means to identify a need, problem, or opportunity for a new product, product line, system design, or service. Student is expected to: (A) explain how technology has changed design throughout history; (B) identify current transitions occurring in	Explain how technology has changed design throughout history, and identify current transitions occurring in design media, technique, and focus. Read and interpret trade journals, assessing the usefulness of each source, to describe the impact technology has had on a particular design discipline. For example, cite evidence from trade journals to explain the impact of three-dimensional printing on industrial engineering practices or the impact of building information modeling software	

			design media, technique, and focus; (C) identify sources for design and drafting information; (D) describe the impact technology on engineering practices.	on structural engineering practices. Research an innovative drafting and design pioneer. Synthesize the information and discuss how the individual experimented with nontraditional possibilities for innovative design solutions.	
Project Planning		Solve predictable and unpredictable design-related problems using various types of resources and methodologies as appropriate.	Use the design process to plan and create a solution for a given design problem. Students are expected to: (A) select and create appropriate drawings to explain the solution, including sketches and multiple views of two-dimensional scale drawings; (B) explain how each step of the design process was followed to complete the project; and (C) analyze the key characteristics of the design which make it an appropriate solution for the given constraints.	Develop a project plan and use the design process to create a solution for moderately complex problem sets, utilizing both simple three-dimensional modeling techniques and detailed technical two-dimensional and three-dimensional scale drawings. Prepare a persuasive narrative to justify the design, describing the constraints of the design and defending how the design solves the identified problem(s). At the completion of the design process, publish the narrative and design and present the design to an audience, receive feedback, and critique the designs of other classmates. Choose between alternate design solutions for a given design problem and justify the choices. Make a written case for selecting one design over another, highlighting the design features of each and citing resources to validate claims. Demonstrate the ability to pitch	

				the idea to the client in a presentation, defending the design by pointing to specific features that meet the client's specifications.	