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

Learning that works for Colorado CTE®

Colorado CTE Course – Scope and Sequence

Course Name	Drafting and Design Technology II	Course Details	Credit = 1.0 Prerequisite: Drafting and Design Technology I
		Course = 0.50 Carnegie Unit Credit	
Course Description	This class will expand on the basic principles of drafting and design and how drafting can be used in architecture, industrial design, engineering, graphic arts and other professions. Protocols dictated by various industries and their drafting standards will be introduced. 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.		
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 Development		Strategize informed career decisions that reflect career goals. Determine employment and entrepreneurial opportunities and preparation requirements in drafting and design and related fields.	Students will utilize career exploration software to research educational requirements for comparison of chosen career paths. Student will be expected to: A) Identify career opportunities in architectural B) and mechanical drafting; C) Understand the education and	Create a list of career opportunities that are linked to career match maker. Propose short-term and long-term career goals. Presentation on career choice. Research the postsecondary institutions (colleges of applied technology, community colleges, and four-year universities) in Colorado and other states that offer architecture or engineering programs. Write an	

			training requirements for D) specific careers; E) Understand the importance of industry certifications; F) Identify potential job outlook based on location; G) Identify and use appropriate work habits; H) Demonstrate respect for diversity in the workplace; and I) Demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality.	informative paper or develop an 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.	
Applied Geometrical Design and Measurements		Demonstrate the use of geometric construction drafting and design principles. Make formal geometric constructions with a computer-aided design and drafting software. Utilizing the correct geometric shapes and	Student is expected to: A) Define appropriate drafting and design terminology; B) Understand how to reference standards from the American Society of Mechanical Engineers;	Demonstrate Geometric construction techniques (tangencies, circles, arc, lines, polygons, ellipses, lines to quadrants, & irregular curves). Define common Mechanical Drafting Vocabulary. Demonstrate accuracy when producing a	

		lettering, properly illustrating drawings in a professional manner. Utilizing proper dimensioning techniques to make drawings understandable.	C) Identify geometric symbols and terms related to geometric dimension and tolerancing (GD&T); D) Define geometric terms and recognize various geometric shapes by name; E) Use lines, circles, and arcs to construct regular and irregular geometric shapes; F) Construct angles, to include acute, obtuse, and right angles; G) Divide lines and bisect angles and arcs; H) Construct tangent, concentric, and perpendicular geometric relationships; I) Calculate area, perimeter, and volume of geometric shapes to include circle, square, rectangle, and triangle; J) Justify the scaling of objects; K) Determine appropriate	geometric drawing, including: • Draw elements that are accurate and to scale • Create limit dimensions • Identify a clearance fit, interference fit, and transition fit • Dimension two mating parts using limit dimension, unilateral tolerances and bilateral tolerances • Dimension two mating parts using limit dimension, unilateral tolerances and bilateral tolerances • Draw geometric tolerancing symbols • Specify position and geometric tolerances • Draw and place feature control symbols and datum references on a drawing. Describe the nominal size, tolerance, limits and allowance of two mating parts. Describe basic hole and shaft systems.	

			engineering and metric scales; L) Measure and calculate object size, area, and volume; M) Construct drawings utilizing metric and customary (i.e., SAE, Imperial) measurement systems; N) Transcribe drawings accurately using ratios and proportions; O) Determine and apply the equivalence between fractions and decimals; and P) Convert between customary (i.e., SAE, Imperial) and metric systems.		
Advanced Drafting and Design CADD Skills		Create and render objects using parametric modeling tools.	The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to: A) Identify and incorporate the use of advanced layout techniques and	Use computer-aided drafting (CAD) software to create two-dimensional drawings of advancing complexity, accurately incorporating symbols, notes, dimensioning, and line types to design drawings. Perform software operations such as utilizing sheets/layouts for printing, scaling viewports in sheets/layouts for printing,	

			viewports using paper-space and modeling areas; B) Use management techniques by setting up properties to define and control individual layers; C) Create and use custom templates for advanced project management; D) Prepare and use advanced development drawings; E) Use advanced polar tracking and blocking techniques to increase drawing efficiency; F) Create drawings that incorporate external referencing; G) Create and render objects using parametric modeling tools; and H) Model individual parts or assemblies and produce rendered or animated output.	printing drawings to proper scale, outputting drawings to electronic and paper media, and overlaying drawings on externally-referenced drawings. Use CAD software to create accurate multi-view drawings of objects of advancing complexity using orthographic projection, incorporating symbols, notes, dimensions, and line type (such as hidden lines to show internal or hidden features). Use CAD 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 (such as full, half, offset, broken-out, removed, and revolved sections),	

				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. Create accurate auxiliary view drawings of advancing complexity including depth, height, or width auxiliary views; partial auxiliary views; and auxiliary section views. Draw detailed, schematic, and simplified drawings of various types of threads and fasteners, including unified, square, and acme threads. 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.	
Mechanical Drawings		Understand and apply mechanical drafting vocabulary. Utilizing proper dimensioning techniques to make drawings understandable.	Apply understanding of manufacturing processes to create mechanical drawings. Student is expected to: A) Understand the process of pattern making; B) Identify contemporary	Interpret industry standards to accurately apply dimensions, notes, and symbols on CAD drawings, including arranging dimensions, using various dimension styles and symbols, and avoiding redundancy. Demonstrate the ability to adjust annotation styles and sizes based on the drawing	

			manufacturing processes; C) Identify casting and foundry manufacturing processes; D) Understand the purpose of tooling, jigs, and fixtures in manufacturing processes; E) Apply Drafting Concepts Related to Basic Manufacturing Processes; F) Differentiate appropriate dimension standards (i.e., ANSI, ISO); G) Use various dimensioning styles (i.e., aligned, unidirectional, polar, ordinate, customize software user interface; H) Prepare and use advanced views such as auxiliary, section, and break-away; I) Draw detailed parts, assembly diagrams, and sub-assembly diagrams; J) Indicate tolerances and standard fittings	type and scale. Define tolerance and give examples of general methods for noting tolerances on drawings. 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. Use three-dimensional modeling software to create a simple 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. Draw an orthographic projection with the proper top, front and side views: • Properly align views • Complete a technical drawing using standard sectional views such as full, half, offset,	

			using appropriate library functions; K) Demonstrate understanding of annotation styles and setup by defining units, fonts, dimension styles, notes, and leader lines. L) Demonstrate understanding of position and layout of views including section, cutting, and reference; M) Demonstrate understanding of fold line construction method; N) Plot circles and arcs so they are drawn to conform to the intersection of projection lines and transferred lines; and O) Create thread and fastener representations.	broken-out, removed, & revolved • Identify plane surfaces on isometric boxes • Construct angles on an isometric view • Construct isometric circle and arcs • Construct an isometric view in the center of a drawing space • Construct an oblique drawing in the center of a drawing space • Construct an angle on an oblique drawing • Construct oblique circles • Construct a cavalier oblique drawing of a given object • Construct a cabinet oblique drawing of a given object • Identify the views of perspectives • Construct a drawing to the appropriate size and scale • Construct a one & two point perspective Apply necessary notes, material specifications,	

				symbols, and other data to a drawing Complete a parts list including, parts number, manufacturer's name, manufacturer's stock number, material specs, quantity of each part, and notes for assembly. Complete an assembly drawing showing the relationship the parts have to each other.	
Introduction to Welding Drawings		Understand the various symbols and details that go into manufacturing a welded part. Create basic working drawings that include dimensions, symbols, and other specifications for welding processes.	Understand and apply knowledge of basic welding principles and terminology to welding drawings. Student is expected to: A) Understand how to recognize and draw braw basic weld symbols (fillet, groove, plug/slot, spot/seam, resistance welds) B) Understand the elements needed to create detail drawings for a welded part; C) Understand how to indicate welding	Students will analyze blue prints to determine weld size. Students will create sketches using geometric methods. Understand how designs are communicated through different types of two-dimensional and three-dimensional drawings, physical models, and virtual three-dimensional models within various disciplines, such as architectural, civil, mechanical, electrical, and industrial design. Interpret symbols and notations within the context of each type. Use technology to create a visual display with supporting text to	

			process on a drawing; D) Understand the importance of the design process in quality control in welding drawing; E) Indicate weld size on drawings; F) Indicate finish & contour welds on drawings; G) Indicate field welds on drawing; and H) Indicate basic welding processes.	compare and contrast how different drawing types covered in the coursework are 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. Interpret technical drawings to build a physical model of a design. Select and use the appropriate materials and tools to safely measure components and construct the model. Upon completion, use the technical drawings to check the model for accuracy. Building on techniques practiced in the introductory course, continue to measure, record, and use field measurements to create drawings of increasingly complex objects and layouts. For example, 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. 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.	
Introduction to Architectural Drawings		Understand architectural design concepts related to floor plans.	The student knows the concepts and skills that form the technical knowledge of architectural design. The student is expected to:	Investigate the social, economic, and environmental impact of decisions made by architects and engineers at the local, national, and global levels. Provide a detailed description of the impacts of a	

			A) Demonstrate knowledge of architectural design principles; B) Identify and describe different architectural styles; C) Identify construction terminology and materials; D) Identify and apply architectural symbols; E) List and describe drawings necessary for a building permit; F) Prepare a floor plan from an existing plan; G) Create an exterior elevation from an existing floor plan; H) Create interior elevations (i.e., kitchen, bathroom); I) Create building sections and details from an existing floor plan (i.e., wall section); and J) Prepare and draft schedules (i.e., window, door, room).	specific discipline, citing links to relevant websites to illustrate the ideas presented. For example, describe how Structural engineers design structural systems in buildings to protect occupants from earthquakes and tornadoes, and illustrate how the materials selected by the engineer impact the environment and economy. Research the principles of sustainable design. Examine a case study of an energy efficient building and determine whether the principles of sustainable design are illustrated in the design of the building. Assess whether the evidence presented is strong enough to support claims of sustainability, and compile a brief persuasive narrative summarizing conclusions. Research design processes used by architects and engineers. Drawing on Multiple resources, explain the steps to the design process in a written narrative, synthesizing a range of perspectives on the process as practiced in a variety of	

				architectural and engineering disciplines. Explain why it is an iterative process and always involves refinement. Create accurate manual single-view scale drawings of advancing complexity, incorporating symbols, notes, and dimensions, using appropriate layout within title blocks, drawing composition (including line weight and line type), geometric construction techniques, and lettering techniques. For example, create a drawing of a metal plate at half scale using an engineer's scale and other tools. After more practice, create a floor plan of the classroom at quarter scale using an architect's scale and other tools. Create accurate multi-view scale drawings of objects of advancing complexity using orthographic projection. Incorporate symbols, notes, dimensions, and different types of lines (such as hidden lines to show internal or hidden features). Demonstrate procedures to establish a principle view of an object and project from an	

				existing view to create additional views.	