

Intermediate Computer Aided Design and Drafting

Subject: Career and Technical Education

Grade: 10

Expectations: 96

Breakouts: 165

(a) Introduction.

1. Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.
2. The Science, Technology, Engineering, and Science (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
3. In Intermediate Computer-Aided Design and Drafting (CADD), students develop practices and techniques used in computer-aided drafting, emphasizing the development and use of prototype drawings, construction of pictorial drawings, construction of three-dimensional drawings, interfacing two-dimensional and three-dimensional environments, and extracting data. Basic rendering techniques will also be developed. Emphasis is placed on drawing set-up; creating and modifying geometry; storing and retrieving predefined shapes; placing, rotating, and scaling objects; adding text and dimensions; using layers and coordinating systems, as well as using input and output devices.
4. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
5. Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(b) Knowledge and Skills Statements

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) describe the roles, responsibilities, and dynamics of a team as applied in appropriate industry fields;
 - (i) describe the roles of a team as applied in appropriate industry fields
 - (ii) describe the responsibilities of a team as applied in appropriate industry fields
 - (iii) describe the dynamics of a team as applied in appropriate industry fields
 - (B) explain employers' work expectations;
 - (i) explain employers' work expectations
 - (C) demonstrate knowledge of the concepts and skills related to health and safety in the workplace as specified by appropriate governmental regulations;
 - (i) demonstrate knowledge of the concepts related to health in the workplace as specified by appropriate governmental regulations
 - (ii) demonstrate knowledge of the concepts related to safety in the workplace as specified by appropriate governmental regulations

- (iii) demonstrate knowledge of the skills related to health in the workplace as specified by appropriate governmental regulations
 - (iv) demonstrate knowledge of the skills related to safety in the workplace as specified by appropriate governmental regulations
- (D) evaluate and justify decisions based on ethical reasoning;
- (i) evaluate decisions based on ethical reasoning
 - (ii) justify decisions based on ethical reasoning
- (E) evaluate alternative responses to workplace situations based on personal, professional, ethical, and legal responsibilities and employer policies;
- (i) evaluate alternative responses to workplace situations based on personal responsibilities
 - (ii) evaluate alternative responses to workplace situations based on professional responsibilities
 - (iii) evaluate alternative responses to workplace situations based on ethical responsibilities
 - (iv) evaluate alternative responses to workplace situations based on legal responsibilities
 - (v) evaluate alternative responses to workplace situations based on employer policies
- (F) identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace;
- (i) identify personal consequences of unethical or illegal behaviors in the workplace
 - (ii) identify long-term consequences of unethical or illegal behaviors in the workplace
 - (iii) explain personal consequences of unethical or illegal behaviors in the workplace
 - (iv) explain long-term consequences of unethical or illegal behaviors in the workplace
- (G) interpret and explain written organizational policies and procedures; and
- (i) interpret written organizational policies
 - (ii) interpret written organizational procedures
 - (iii) explain written organizational policies
 - (iv) explain written organizational procedures
- (H) demonstrate personal responsibility, ethics, and integrity, including respect for intellectual property, when accessing information and creating design projects.
- (i) demonstrate personal responsibility, including respect for intellectual property, when accessing information
 - (ii) demonstrate personal responsibility, including respect for intellectual property, when creating design projects
 - (iii) demonstrate ethics, including respect for intellectual property, when accessing information
 - (iv) demonstrate ethics, including respect for intellectual property, when creating design projects
 - (v) demonstrate integrity, including respect for intellectual property, when accessing information
 - (vi) demonstrate integrity, including respect for intellectual property, when creating design projects

- (2) The student demonstrates an understanding of CADD terminology, tools, and symbols. The student is expected to:
- (A) apply the Cartesian Coordinate Systems to illustrate the application of Z coordinates;
 - (i) apply the Cartesian Coordinate Systems to illustrate the application of Z coordinates
 - (B) describe the CADD menu structure;
 - (i) describe the CADD menu structure
 - (C) differentiate between type-in commands, icons, and pulldown menus;
 - (i) differentiate between type-in commands, icons, and pulldown menus
 - (D) manipulate the standard draw commands;
 - (i) manipulate the standard draw commands
 - (E) demonstrate modifying commands;
 - (i) demonstrate modifying commands
 - (F) explain the various modes of viewing drawings; and
 - (i) explain the various modes of viewing drawings
 - (G) define and modify dimension styles.
 - (i) define dimension styles
 - (ii) modify dimension styles
- (3) The student produces hand sketches to organize ideas and communicate design ideas. The student is expected to:
- (A) demonstrate the use of graphic descriptions;
 - (i) demonstrate the use of graphic descriptions
 - (B) develop skill in sketching or mark making to plan, execute, and construct two-dimensional images and three-dimensional models;
 - (i) develop skill in sketching or mark making to plan two-dimensional images
 - (ii) develop skill in sketching or mark making to plan three-dimensional models
 - (iii) develop skill in sketching or mark making to execute two-dimensional images
 - (iv) develop skill in sketching or mark making to execute three-dimensional models
 - (v) develop skill in sketching or mark making to construct two-dimensional images
 - (vi) develop skill in sketching or mark making to construct three-dimensional models
 - (C) demonstrate methods of projection; and
 - (i) demonstrate methods of projection
 - (D) use proper drafting techniques to convert sketches into an electronic drawing using CADD.
 - (i) use proper drafting techniques to convert sketches into an electronic drawing using CADD

(4) The student demonstrates an understanding of commands in a CADD system. The student is expected to:

- (A) operate CADD software;
 - (i) operate CADD software
- (B) demonstrate draw commands;
 - (i) demonstrate draw commands
- (C) modify drawn objects in CADD software;
 - (i) modify drawn objects in CADD software
- (D) create two-dimensional and three-dimensional objects;
 - (i) create two-dimensional objects
 - (ii) create three-dimensional objects
- (E) convert two-dimensional drawings to three-dimensional drawings;
 - (i) convert two-dimensional drawings to three-dimensional drawings
- (F) convert three-dimensional drawings to two-dimensional drawings;
 - (i) convert three-dimensional drawings to two-dimensional drawings
- (G) prepare text blocks in CADD software;
 - (i) prepare text blocks in CADD software
- (H) manipulate an external reference or file;
 - (i) manipulate an external reference or file
- (I) import files of different formats into CADD;
 - (i) import files of different formats into CADD
- (J) demonstrate the plot command in print or plot drawings; and
 - (i) demonstrate the plot command in print or plot drawings
- (K) import and export data using attributes.
 - (i) import data using attributes
 - (ii) export data using attributes

(5) The student performs computer-aided drafting functions. The student is expected to:

- (A) create text styles, text justification, and multi-line text;
 - (i) create text styles
 - (ii) create text justification
 - (iii) create multi-line text
- (B) create and use multi-leaders;
 - (i) create multi-leaders
 - (ii) use multi-leaders

- (C) edit dimensions;
 - (i) edit dimensions
- (D) work with dimension styles;
 - (i) work with dimension styles
- (E) crosshatch objects;
 - (i) crosshatch objects
- (F) isolate and hide objects;
 - (i) isolate objects
 - (ii) hide objects
- (G) use selection set methods;
 - (i) use selection set methods
- (H) use rectangular, polar, and path arrays;
 - (i) use rectangular arrays
 - (ii) use polar arrays
 - (iii) use path arrays
- (I) use rotation reference angles;
 - (i) use rotation reference angles
- (J) use elements of creativity and organizational principles to create visually coherent viewports and layouts;
 - (i) use elements of creativity to create visually coherent viewports
 - (ii) use elements of creativity to create visually coherent layouts
 - (iii) use elements of organizational principles to create visually coherent viewports
 - (iv) use elements of organizational principles to create visually coherent layouts
- (K) create and manage layers and properties;
 - (i) create layers
 - (ii) create properties
 - (iii) manage layers
 - (iv) manage properties
- (L) use page setup for plotting;
 - (i) use page setup for plotting
- (M) create, insert, and edit reusable content such as symbols and blocks;
 - (i) create reusable content
 - (ii) insert reusable content
 - (iii) edit reusable content

- (N) use specific line types using the Standard Alphabet of Lines;
 - (i) use specific line types using the Standard Alphabet of Lines
- (O) create fills and gradients; and
 - (i) create fills
 - (ii) create gradients
- (P) edit hatch patterns and fills.
 - (i) edit hatch patterns
 - (ii) edit fills

(6) The student creates drawings using the CADD software. The student is expected to:

- (A) translate hand sketches into CADD software;
 - (i) translate hand sketches into CADD software
- (B) create projected mechanical drawings;
 - (i) create projected mechanical drawings
- (C) create drawings with external references;
 - (i) create drawings with external references
- (D) complete a three-dimensional parametric model;
 - (i) complete a three-dimensional parametric model
- (E) organize a complex assembly, including an animated exploded assembly;
 - (i) organize a complex assembly, including an animated exploded assembly
- (F) compare various methods of drawing solids;
 - (i) compare various methods of drawing solids
- (G) construct a composite drawing using multiple drawings;
 - (i) construct a composite drawing using multiple drawings
- (H) justify correct drawing methods;
 - (i) justify correct drawing methods
- (I) draw lines, arcs, and circles to represent plans or mechanical assemblies;
 - (i) draw lines to represent plans or mechanical assemblies
 - (ii) draw arcs to represent plans or mechanical assemblies
 - (iii) draw circles to represent plans or mechanical assemblies
- (J) create text styles, text justification, and multi-line text;
 - (i) create text styles
 - (ii) create text justification
 - (iii) create multi-line text

- (K) create and use multi-leaders;
 - (i) create multi-leaders
 - (ii) use multi-leaders
 - (L) edit dimensions, including dimension styles;
 - (i) edit dimensions, including dimension styles
 - (M) isolate and hide objects;
 - (i) isolate objects
 - (ii) hide objects
 - (N) use selection set methods;
 - (i) use selection set methods
 - (O) use elements of creativity and organizational principles to create visually coherent viewports and layouts;
 - (i) use elements of creativity to create visually coherent viewports
 - (ii) use elements of creativity to create visually coherent layouts
 - (iii) use elements of organizational principles to create visually coherent viewports
 - (iv) use elements of organizational principles to create visually coherent layouts
 - (P) create and manage layers;
 - (i) create layers
 - (ii) manage layers
 - (Q) use page setup for plotting; and
 - (i) use page setup for plotting
 - (R) prepare multi-view drawings, including sectional and auxiliary views.
 - (i) prepare multi-view drawings, including sectional views
 - (ii) prepare multi-view drawings, including auxiliary views
- (7) The student creates electrical drawings. The student is expected to:
- (A) prepare schematic drawings;
 - (i) prepare schematic drawings
 - (B) prepare printed circuit board assembly drawing packages;
 - (i) prepare printed circuit board assembly drawing packages
 - (C) prepare connection drawings;
 - (i) prepare connection drawings
 - (D) prepare interconnection drawings;
 - (i) prepare interconnection drawings

- (E) prepare wiring drawings;
 - (i) prepare wiring drawings
- (F) prepare cable drawings and/or harness drawings;
 - (i) prepare cable drawings and/or harness drawings
- (G) prepare component drawings; and
 - (i) prepare component drawings
- (H) prepare logic diagrams.
 - (i) prepare logic diagrams

(8) The student creates mechanical drawings. The student is expected to:

- (A) prepare fastener, cam, gear, spring, and bearing drawings;
 - (i) prepare fastener drawings
 - (ii) prepare cam drawings
 - (iii) prepare gear drawings
 - (iv) prepare spring drawings
 - (v) prepare bearing drawings
- (B) prepare detail drawings;
 - (i) prepare detail drawings
- (C) prepare surface developments;
 - (i) prepare surface developments
- (D) prepare welding drawings;
 - (i) prepare welding drawings
- (E) prepare bearing drawings;
 - (i) prepare bearing drawings
- (F) prepare casting drawings;
 - (i) prepare casting drawings
- (G) prepare forging drawings;
 - (i) prepare forging drawings
- (H) prepare tool drawings;
 - (i) prepare tool drawings
- (I) prepare molding diagrams;
 - (i) prepare molding diagrams
- (J) prepare stamping drawings;
 - (i) prepare stamping drawings

- (K) prepare numerical-control drawings;
 - (i) prepare numerical-control drawings
 - (L) modify drawings to include material specifications and parts list; and
 - (i) modify drawings to include material specifications
 - (ii) modify drawings to include parts list
 - (M) identify geometric tolerances and dimensioning of specific machined surfaces.
 - (i) identify geometric tolerances of specific machined surfaces
 - (ii) identify geometric dimensioning of specific machined surfaces
- (9) The student prepares CADD project designs. The student is expected to:
- (A) develop a floor plan depicting all elements of the building, including BIM (building information modeling);
 - (i) develop a floor plan depicting all elements of the building, including BIM (building information modeling)
 - (B) render a site plan that depicts all elements of the site;
 - (i) render a site plan that depicts all elements of the site
 - (C) render exterior and interior elevations;
 - (i) render exterior elevations
 - (ii) render interior elevations
 - (D) draw a specified roof type within a plan;
 - (i) draw a specified roof type within a plan
 - (E) prepare door and window schedules;
 - (i) prepare door schedules
 - (ii) prepare window schedules
 - (F) draw a wall and building section;
 - (i) draw a wall section
 - (ii) draw a building section
 - (G) draw an overall site plan;
 - (i) draw an overall site plan
 - (H) draw a building plot plan;
 - (i) draw a building plot plan
 - (I) review and revise plans throughout the design process to refine and achieve design objective;
 - (i) review plans throughout the design process to refine design objective
 - (ii) review plans throughout the design process to achieve design objective
 - (iii) revise plans throughout the design process to refine design objective
 - (iv) revise plans throughout the design process to achieve design objective

- (J) demonstrate flexibility and adaptability throughout the design process; and
 - (i) demonstrate flexibility throughout the design process
 - (ii) demonstrate adaptability throughout the design process
- (K) define a basic project materials list.
 - (i) define a basic project materials list