COMPUTERS IN DESIGN AND PRODUCTION

Computers in Design and Production is a course that specializes in using modern technological processes, computers, design, and production systems in the production of products and structures through the use of automated production systems. Emphasis is placed on using modern technologies and on developing career related skills for electronics, manufacturing, precision machining, welding, and architecture career pathways. Students use tools, materials, processes, and resources to create solutions as it applies in the areas of electronics, manufacturing, precision machining, welding, and architecture. The content and activities should be developed locally in accordance with available advanced technologies in the school. Course content should address major technological content related to topics such as: Architectural drawing and print design, design documentation using CAD systems; assignments involving the interface of CAD, CNC, CAM, and CIM technologies; computer simulation of products and systems; publishing of various media; animation and related multimedia applications; 3-D modeling of products or structures; digital creation and editing of graphics and audio files; control technologies; and automation in the modern workplace.

- DOE Code: 4800
- Recommended Grade Level: 9-10
- Recommended Prerequisites: None
- Credits: 2 semester course, 2 semesters required, 1 credit per semester, maximum of 2 credits
- Fulfills a Directed Elective or Elective requirement for all diploma types

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences.

Content Standards

Domain – Core Concepts
Core Standard 1 Students apply concepts of the design process using writing, math, and CAD skills for solving a design problem.

Standards

CPD-1.1   Identify components related to the design process.

CPD-1.2   Describe the steps in the design process.

CPD -1.3   Describe the elements and principles of design.

CPD -1.4   Make and use measurements in both traditional and metric units.

CPD -1.5   Apply and adapt the design process from conception through verification of a simple component or system.

CPD-1.6   Review CAD drawing design.

CPD-1.7   Demonstrate drafting concepts and the use of drafting tools.

CPD-1.8   Develop an understanding of geometry related to technical drawing and actual production objects.

CPD-1.9   Apply concepts of 3D CAD drawing and animation during the design process.

CPD-1.10   Use "real world" measuring tools and teaming concepts to create production models.

CPD-1.11   Solve technical mathematical problems.

CPD-1.12   Create multi-view drawings using 2D and 3D CAD.

CPD-1.13   Develop 3-D product models using solid modeling and parametric CAD software.

CPD-1.14   Understand concept sketching.

CPD-1.15   Create a presentation of a design using various methods.

CPD-1.16   Utilize Computer Aided Drafting (CAD) skills to produce drawings.

CPD-1.17   Identify common terms and definitions relating to Computer Aided Drafting.

CPD-1.18   Write a descriptive report on some aspect of the design process and how it relates to a project.

Domain – Electronics

Core Standard 2 Students verify electronic concepts for use in electronic schematics.

Standards

CPD-2.1   Design basic electronic schematics.

CPD-2.2   Identify and describe basic electronic laws.

CPD-2.3   Describe AC/DC concepts.

CPD-2.4   Apply basic logic found in electronics.

CPD-2.4   Identify symbols used in creating schematics.

CPD-2.5   Recognize and explain the functions of electronic components.

Domain – Advanced Manufacturing

Core Standard 3 Students integrate advanced manufacturing concepts in the design process to develop projects.

Standards

CPD-3.1   Apply the principles of mold design for a variety of products.

CPD-3.2   Identify necessary mold materials, stress and strength calculations, machining, fabricating, and testing in processing equipment needed to produce a product.

CPD-3.3   Describe the design of the manufacturing process as required by product design specifications.

CPD-3.4   Identify the selection of processes, tooling, work-holding, gauging, routing, and material handling, as developed for a manufacturing production simulation.

CPD-3.5   Demonstrate process planning; cost and efficiency analysis.

CPD-3.6   Demonstrate planning for ergonomics, robotics, machine tools, coordinate-measuring machines, and custom automation for a product.

CPD-3.7   Use simulation software to design a factory layout and material-flow simulation.

CPD-3.8   Design for product-ability and manufacturing ease.

CPD-3.9   Understand how robots operate in a work cell.

CPD-3.10   Incorporate print reading for applications.

Domain – Precision Machining
Core Standard 4 Students choose precision machining concepts to use in creating a solution.

    Standards

    CPD-4.1   Explain the practical considerations associated with the use of FEA (Finite Element Analysis) with respect to product stress and strain analysis.

    CPD-4.2   Identify geometric dimensioning and tolerancing, and surface texture specifications.

    CPD-4.3   Identify a wide range of rapid prototyping technologies and materials.

    CPD-4.4   Explain why rapid prototyping is a useful technique in designing a product.

    CPD-4.5   Convert/create products using modeling software, convert drawings using appropriate software and produce a product using a rapid prototyping technique.

    CPD-4.6   Demonstrate the ability to model/prototype to scale.

    CPD-4.7   Understand and practice orthographic projection drawings as related to practical applications.

    CPD-4.8   Understand and practice axonometric projection drawings as related to practical applications.

    CPD-4.9   Demonstrate robotics programming and CAD/CAM/CNC programming for producing the instruction codes necessary to manufacture parts with NC machine tools are emphasized.

    CPD-4.10   Incorporate precision tool reading for applications.

    CPD-4.11   Show understanding of coordinate systems.

Domain – Welding
Core Standard 5 Students recommend welding methods to be used on a particular type of material in accordance to the use of the product.

    Standards

    CPD-5.1   Identify welding types through finite/stress analysis.

    CPD-5.2   Incorporate print reading for applications.

    CPD-5.3   Identify welding symbols used on drawings.

    CPD-5.4   Describe different types of welding.

Domain – Architecture
Core Standard 6 Students integrate architecture concepts in the design process to develop projects.

    Standards

    CPD-6.1   Demonstrate an understanding of various historical house styles.

    CPD-6.2   Assess space planning for occupant use.

    CPD-6.3   Recognize and explain how building codes and ordinances affect design.

    CPD-6.4   Identify the drawings required for residential construction.

    CPD-6.5   Create architectural blueprints.

    CPD-6.6   Select the appropriate scale using an architect's scale.

    CPD-6.7   Identify and apply architectural symbols used on drawings.

    CPD-6.8   Identify the proper use of site analysis.

    CPD-6.9   Demonstrate knowledge of roof systems, terminology, style, and construction.

    CPD-6.10   Identify various styles of roof systems.

CPD-6.11   Explain the purpose of elevations.

CPD-6.12   Evaluate different foundation systems and terminology.

CPD-6.13   Analyze mechanical systems present in residential construction.

Domain – Careers in Electronics, Advanced Manufacturing, Precision Machining, Welding, and Architecture.

Core Standard 7 Students evaluate potential career opportunities in electronics, advanced manufacturing, precision machining, welding, and architecture.

Standards

CPD-7.1   Research electronics, advanced manufacturing, precision machining, welding, and architecture careers.

CPD-7.2   Find electronics, advanced manufacturing, precision machining, welding, and architecture opportunities offered by a technical school or college.

CPD-7.3   Determine electronics, advanced manufacturing, precision machining, welding, and architecture occupation wages/salaries.

CPD-7.4   Research electronics, advanced manufacturing, precision machining, welding, and architecture job outlook information.

Career and Technical Student Organizations

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in a Career and Technical Student Organization, such as the **Technology Student Association (TSA).**