

Introduction to Engineering Design

Level 2: Student may have explored previously; first pathway specific course

Pathway(s): Engineering & Technology

Description

Introduction to Engineering Design is a fundamental course in the Engineering and Technology Program of Study for students interested in developing their skills in preparation for careers in engineering and technology. The course covers essential knowledge, skills, and concepts required for postsecondary engineering and technology fields of study. Upon completion of this course, proficient students are able to describe various engineering disciplines, as well as admissions requirements for postsecondary engineering and engineering technology programs in Colorado. They will also be able to identify simple and complex machines, calculate various ratios related to mechanisms, explain fundamental concepts related to energy, understand Ohm's Law, follow the steps in the engineering design process to complete a team project, and effectively communicate design solutions to others.

NOTE: This course is still in draft form. While no additional competencies will be added, some may be removed.

Student Learning Outcomes

Safety

- 1) Perform safe practices within the classroom
 - a. Accurately read and interpret safety rules adopted by the school/district as they relate to the spaces and equipment used in this
 - b. Identify and explain the intended use of safety equipment available in the classroom.
 - c. Demonstrate how to properly inspect and use safe operating procedures with tools and equipment
 - d. Incorporate safety procedure

Career and Transfer

- 2) Distinguish the differences between an engineering technician, engineering technologist, and engineer.
- 3) Describe various engineering disciplines (e.g., civil, mechanical, electrical, chemical, biomedical, computer, agricultural, industrial, aerospace, etc.).
 - a. Job roles
 - b. Professional societies
 - c. Applicable licenses and/or certifications
- 4) Research the postsecondary and workforce opportunities that exist within Colorado (technical colleges, community colleges, and four-year universities) with engineering or engineering technology programs.

Working within a Team

- 5) Demonstrate an understanding of and discuss how teams function
- 6) Apply teamwork to solve problems
- 7) Serve as a team leader and member and demonstrate appropriate attitudes while participating in team projects

Project Management

- 8) Implement project management methodologies, including initiating, planning, executing, monitoring, and controlling, and closing a project
- 9) Develop a project schedule and complete projects according to established criteria
- 10) Participate in the organization and operation of a real or simulated engineering project
- 11) Develop a plan for production of an individual product

Project Documentation and Workflow

- 12) Complete work orders and related documentation
- 13) Identify factors affecting cost and strategies to minimize costs
- 14) Prepare a project budget
- 15) Prepare a production schedule
- 16) Identify intellectual property and other legal restrictions
- 17) Read and interpret technical drawings, manuals, and bulletins

Application of Computer-Aided Drafting and Design Software

- 18) Prepare drawings to American National Standards Institute (ANSI) and International Organization for Standards (ISO) graphic standards
- 19) Customize software user interfaces
- 20) Prepare and use advanced views such as auxiliary, section, and break-away
- 21) Draw detailed parts, assembly diagrams, and sub-assembly diagrams
- 22) Indicate tolerances and standard fitting using appropriate library functions
- 23) Demonstrate understanding of annotation styles and setup by defining units, fonts, dimension styles, notes, and leader lines
- 24) Identify and incorporate the use of advanced layout techniques and viewports using paperspace and modeling areas
- 25) Use management techniques by setting up properties to define and control individual layers
- 26) Create and use custom templates for advanced project management
- 27) Prepare and use advanced development drawings
- 28) Use advanced polar tracking and blocking techniques to increase drawing efficiency
- 29) Create drawings that incorporate external referencing
- 30) Create and render objects using parametric modeling tools
- 31) Model individual parts or assemblies and produce rendered or animated output

Engineering Design Methodologies

- 32) Demonstrate an understanding of and discuss principles of system ideation
- 33) Demonstrate critical thinking, identify the system constraints, and make fact-based decisions
- 34) Use rational thinking to develop or improve a system
- 35) Apply decision-making strategies when developing solutions

- 36) Identify quality-control issues in engineering design and production
- 37) Describe perceptions of the quality of products and how they affect engineering decisions
- 38) Use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process
- 39) Use an engineering notebook to record the final design, construction, and manipulation of finished products

Application of Engineering Concepts

- 40) Use a variety of technologies to design systems
- 41) Use tools, laboratory equipment, and precision measuring instruments to develop prototypes
- 42) Research application of different types of CAD software
- 43) Use multiple software applications for concept presentation

Systems Design

- 44) Interpret engineering drawings
- 45) Identify areas where quality, reliability, and safety can be designed into a system
- 46) Improve a system design to meet a specified need, including properties of materials selected
- 47) Produce engineering drawings to industry standards
- 48) Describe potential patents and the patenting process

Build a Prototype

- 49) Identify and describe the steps needed to produce a prototype
- 50) Identify and use appropriate tools, equipment, machines, and materials to produce the prototype
- 51) Present the prototype using a variety of media