Science Standard
Catalina Foothills School District
High School: Introduction to Engineering Design

Introduction to Engineering Design introduces aspects of problem solving, logic and relationships. The course emphasizes problem-solving skills using a design development process. Topics explored include various technology systems, manufacturing processes, and how technological advances affect society. Students use computer software to produce, analyze, and evaluate models of project solutions. They study the design concepts of form and function, and then use state of the art technology to translate conceptual design into reproducible products. The techniques learned and equipment used are currently used in industry by engineers throughout the United States.

STEM INQUIRY: DESIGN PROCESS

ENGR1.1.1 Frames testable questions showing evidence of observations and connections to prior knowledge.

ENGR1.1.2 Develops a testable question appropriate to the technological domain being investigated.

ENGR1.1.3 Determines collaborative efforts needed for question.

ENGR1.1.4 Determines design team benefits and constraints.

STEM INQUIRY: FORMULATING PROPOSED SOLUTIONS

ENGR1.2.1 Develops a testable hypothesis based upon evidence of scientific/technological/mathematical principles, probability and/or modeling.

ENGR1.2.2 Clearly distinguishes relationships between variables (for example: cause & effect or correlation) within a testable hypothesis.

ENGR1.2.3 Describes steps in the design process and explains actions that occur in each phase of problem solution.

STEM INQUIRY: DESIGNING INVESTIGATIONS

ENGR1.3.1 Specifies the parameters of calculation/measurement.

ENGR1.3.2 Describes suitable controls for the investigation.

ENGR1.3.3 Designs procedures that appropriately address the problem.

STEM INQUIRY: PROBLEM DISCOVERY

ENGR1.4.1 Creates safe and ethical procedures.

ENGR1.4.2 Uses units of measurement with appropriate degree of accuracy.

ENGR1.4.3 Creates procedures and applies the steps of the design process that appropriately and adequately address the proposed solution (for example: adequate sample size, multiple trials).

ENGR1.4.4 Creates a suitable method for recording data (for example: data charts, lab notebooks).

STEM INQUIRY: ANALYSIS

ENGR1.5.1 Interprets data to describe relationships between variables (for example: positive, negative, no relationship).

ENGR1.5.2 Incorporates mathematical analysis, where appropriate.

ENGR1.5.3 Critiques the investigation for possible sources of error.

ENGR1.5.4 Initializes process for debugging.

STEM INQUIRY: SYNTHESIS

ENGR1.6.1 Makes evidence-based predictions (for example: extrapolations and interpolations).

ENGR1.6.2 Evaluates whether the data support the hypothesis/proposed solution.

ENGR1.6.3 Verifies selection of process for problem-solving.

STEM INQUIRY: COMMUNICATION

ENGR1.7.1 Uses suitable media to inform an audience about an investigation and its process (for example: presentation aids of engineering designs).

HISTORY OF DESIGN AND THE DESIGN PROCESS

ENGR1.8.1 Explores the evolution of technology (for example: chronological development and rate of change over time in relation to consumer products and improved functionality) and its impact on the field of engineering.

ENGR1.8.2 Describes how the history of art and artistic periods and styles have influenced the field of engineering, products, and architectural design (for example: the impact of artistic expression as it relates to consumer products).

CONCEPT MODELING

ENGR1.9.1 Selects appropriate techniques to portray design solutions (for example: pictorial style, annotated sketches, views, color, form, symbols, shading) for two-dimensional and three dimensional drawings and models.

ENGR1.9.2 Selects and uses appropriate tools to design and construct shapes in selected coordinate systems (for example: absolute, relative, polar).

ENGR1.9.3 Applies geometric and dimensional constraints to generate a 3-D model.

ENGR1.9.4 Generates models using CAD software.

ASSEMBLY MODELING

ENGR1.10.1 Demonstrates assembly modeling skills to solve design problems (for example: applies base component effectively, creates and places components, applies assembly and drive constraints).

ENGR1.10.2 Applies adaptive design concepts.

ENGR1.10.3 Evaluates accuracy of mass properties and tolerance calculations.

ENGR1.10.4 Demonstrates use of appropriate dimensioning practices and techniques (for example: section, auxiliary, and assembly models; annotate drawings; generate general and proprietary specifications).

PRODUCTION

ENGR1.11.1 Categorizes manufacturing specifications and constraints needed to produce a product.

ENGR1.11.2 Evaluates and applies correct machine processes (for example: process routing).

MARKETING

ENGR1.12.1 Performs product cost analysis.

ENGR1.12.2 Analyzes requirements for packaging a given product.

Note: This is a CTE/JTED course.