Science Standard
Catalina Foothills School District
High School: Principals of Engineering
Grades 10-12

The course, Principles of Engineering is designed to integrate science and math skills into engineering and engineering technology. Students will gain an understanding of the intricacies associated with technology systems and manufacturing processes. Students will learn how engineers and technicians use math, science and technology in an engineering problem solving process to benefit people. Students will engage in hands-on, real-world projects, to gain an appreciation for social and political consequences of technological change. This course emphasizes the relevancy of math and science skills.

1. STEM INQUIRY: DESIGN PROCESS	
PRENGR1.1.1	Frames testable questions showing evidence of observations and connections to prior knowledge.
PRENGR1.1.2	Develops a testable question or problem statement appropriate to the technological domain being investigated.
PRENGR1.1.3	Determines collaborative efforts needed for question.
PRENGR1.1.4	Determines design team benefits and constraints.
2. STEM INQUIRY: FORMULATING PROPOSED SOLUTIONS	
PRENGR1.2.1	Develops a testable hypothesis based upon evidence of scientific/technological/mathematical principles, probability and/or modeling.
PRENGR1.2.2	Clearly distinguishes relationships between variables *(for example: cause & effect or correlation)* within a testable hypothesis.
PRENGR1.2.3	Describes steps in the design process and explains actions that occur in each phase of problem solution.
3. STEM INQUIRY: DESIGNING INVESTIGATIONS	
PRENGR1.3.1	Specifies the parameters of calculation/measurement.
PRENGR1.3.2	Describes suitable controls for the investigation.
PRENGR1.3.3	Designs procedures that appropriately address the problem.
4. STEM INQUIRY: PROBLEM DISCOVERY	
PRENGR1.4.1	Creates safe and ethical procedures.
PRENGR1.4.2	Uses units of measurement with appropriate degree of accuracy.
PRENGR1.4.3	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)*.
PRENGR1.4.4	Creates a suitable method for recording data *(for example: data charts, lab notebooks)*.
5. STEM INQUIRY: ANALYSIS	
PRENGR1.5.1	Interprets data to describe relationships between variables *(for example: positive, negative, no relationship)*.
PRENGR1.5.2	Incorporates mathematical analysis, where appropriate.
PRENGR1.5.3	Critiques the investigation for possible sources of error.
PRENGR1.5.4	Initializes process for debugging.
6. STEM INQUIRY: SYNTHESIS	
PRENGR1.6.1	Makes evidence-based predictions *(for example: extrapolations and interpolations)*.
PRENGR1.6.2	Evaluates whether the data support the hypothesis/proposed solution.
PRENGR1.6.3	Verifies selection of process for problem-solving.
7. STEM INQUIRY: COMMUNICATION	
PRENGR1.7.1	Uses suitable media to inform an audience about an investigation and its process *(for example: presentation aids of engineering designs)*.

8. INTERACTION OF TECHNOLOGY AND SOCIETY	
PRENGR1.8.1	Describes the interaction of technology, human curiosity, and societal needs.
PRENGR1.8.2	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.
PRENGR1.8.3	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).*
9. CONCEPT MODELING	
PRENGR1.9.1	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.
PRENGR1.9.2	Selects and uses appropriate tools to design and construct shapes in selected coordinate systems *(for example: absolute, relative, polar).*
PRENGR1.9.3	Applies geometric and dimensional constraints to generate a 3-D model.
PRENGR1.9.4	Generates models using CAD software.
10. PRODUCTION	
PRENGR1.10.1	Categorizes manufacturing specifications and constraints needed to produce a product.
PRENGR1.10.2	Evaluates and applies correct machine processes *(for example: process routing*).
11. MOTION AND FORCES	
PRENGR1.11.1	Analyzes relationships between forces and motion.
PRENGR1.11.2	Analyzes forces in static equilibrium.
PRENGR1.11.3	Determines the rate of change of a quantity *(for example: rate of erosion, rate of reaction, rate of growth, velocity)*.
PRENGR1.11.4	Analyzes the relationships among position, velocity, acceleration, and time.
PRENGR1.11.5	Explains how Newton's Laws apply to various situations.
12. ENERGY IN SYSTEMS OF PARTICLES	
PRENGR1.12.1	Describes the flow of energy to and from different systems.
PRENGR1.12.2	Analyzes energy interactions in terms of changes in potential and kinetic energy.
PRENGR1.12.3	Describes various ways that energy is transformed, but is conserved.
PRENGR1.12.4	Explains the mechanisms of heat transfer (convection, conduction, radiation).
13. ELECTRICITY AND MAGNETISM	
PRENGR1.13.1	Describes Ohm's Law and uses it to analyze simple circuits.
PRENGR1.13.2	Demonstrates how electric and magnetic fields interact.
14. ELECTRICAL SYSTEMS	
PRENGR1.14.1	Describes the flow of energy to and from different components in an electrical system.
PRENGR1.14.2	Analyzes energy interactions in terms of changes in potential energy.
PRENGR1.14.3	Explains the mechanisms of energy transfer within the system.
PRENGR1.14.4	Explains specific safety measures necessary in using electrical equipment.
15. MECHANICAL SYSTEMS	
PRENGR1.15.1	Describes the flow of energy to and from different components in a mechanical system.
PRENGR1.15.2	Analyzes energy interactions in terms of changes in potential and kinetic energy.
PRENGR1.15.3	Explains the mechanisms of energy transfer within the system.
PRENGR1.15.4	Calculates mechanical advantage from parameters of a device.
16. PNEUMATIC SYSTEMS	
PRENGR1.16.1	Describes the flow of energy to and from different components in a pneumatic system.
PRENGR1.16.2	Analyzes energy interactions in terms of changes in potential and kinetic energy.
PRENGR1.16.3	Explains the mechanisms of energy transfer.
PRENGR1.16.4	Predicts behavior of pneumatic systems based on calculations of force and pressure.

17. HYDRAULIC SYSTEMS	
PRENGR1.17.1	Describes the flow of energy to and from different components in a hydraulic system.
PRENGR1.17.2	Analyzes energy interactions in terms of changes in potential and kinetic energy.
PRENGR1.17.3	Explains the mechanisms of energy transfer.
PRENGR1.17.4	Predicts behavior of hydraulic systems based on calculations of force and pressure.
18. THERMODYNAMIC SYSTEMS	
PRENGR1.18.1	Describes the flow of energy to and from different components of thermodynamic systems.
PRENGR1.18.2	Analyzes energy interactions in terms of changes in potential and kinetic energy.
PRENGR1.18.3	Explains how energy is conserved during processes in a thermodynamic system.
PRENGR1.18.4	Explains the mechanisms of energy transfer (convection, conduction, radiation).
PRENGR1.18.5	Calculates energy changes in thermodynamic processes.

Note: This is a CTE/JTED course.