

CHINO VALLEY UNIFIED SCHOOL DISTRICT
INSTRUCTIONAL GUIDELINES
GATEWAY TO TECHNOLOGY

Course Number	3149
Department	Elective
Prerequisite	Concurrent enrollment in Science 8 and Algebra 1
Length of Course	One (1) year/Three (3) trimesters
Grade Level	8
Credit	Elective
Repeatable	Not repeatable for credit
Board Approved	July 15, 2010

Description of Course – Gateway to Technology (GTT) was developed as an introductory course to expose middle school students to concepts of design and engineering. It is an activity, project, and problem-based learning program which challenges and engages the natural curiosity of students, while they gain skills needed to develop, produce, and use products and services. A team approach promotes communication and collaboration to utilize the strengths of each team member. The course comprises six units giving students a broad spectrum of engineering and technology sub-disciplines. GTT also supports and enhances California State Standards in algebra and science. The course is aligned with the Project Lead the Way (PLTW) program. Students can continue their study of engineering in the high school PLTW Engineering and Design course.

Rationale for Course – The global economy is becoming increasingly high-tech and high-skill based. This course is designed to give students a foundational knowledge and overview in the areas of applied science, technology, engineering, and mathematics (STEM), and to help build later success in those areas. The team approach fosters communication and cooperation, while the rigorous problem-based learning requires them to be creative, innovative, and to think outside the box.

Design and Modeling

Standard 1 – Students use solid modeling software to understand how design influences their lives.

1.1 Objective: Learn how humans develop new products to meet needs.

1.1.1 Performance Indicator: Students will identify the six major groups of technological resources.

1.1.2 Performance Indicator: Students will investigate a major development or invention that occurred in the last 100 years.

- 1.1.3 Performance indicator: Students will prepare an engineer's notebook to use during the unit.
- 1.2 Objective: Learn about basic elements in the design process to solve a community technical problem.
 - 1.2.1 Performance Indicator: Students will assign roles within a design team that they create.
 - 1.2.2 Performance Indicator: Students will design a simple measurement instrument.
 - 1.2.3 Performance Indicator: Students will identify basic elements of design and learn how a design leads to something functional.
 - 1.2.4 Performance Indicator: Students will work in teams to solve a community technical problem.
- 1.3 Objective: Create and interpret sketches with multiple views.
 - 1.3.1 Performance Indicator: Students will draw rapid, accurate sketches as a tool to communicate ideas.
 - 1.3.2 Performance Indicator: Students will create portfolios of sketches drawn with multi-views of an object.
 - 1.3.3 Performance Indicator: Students will analyze the differences between isometric and orthographic drawings.
- 1.4 Objective: Learn basic computer modeling techniques.
 - 1.4.1 Performance Indicator: Students will combine basic geometric shapes to create a representation of an object.
 - 1.4.2 Performance Indicator: Students will use descriptive geometry, geometric relationships, and dimensions to communicate an idea or solution to a technological problem.
 - 1.4.3 Performance Indicator: Students will learn about the coordinate systems and how they are used to describe shapes.
 - 1.4.4 Performance Indicator: Students will fabricate a prototype of a 3D object following specified criteria and constraints.

Automation and Robotics

Standard 2 – Students learn about the use of robotics in today's world, including mechanical systems, energy transfer, machine automation, and computer control systems.

2.1 Objective: Understand how robotics is used in the world today.

2.1.1 Performance Indicator: Students will know that automation is the process of operating machines with minimal human control.

2.1.2 Performance Indicator: Students will describe ways that robotics have a positive and a negative effect in industry.

2.1.3 Performance Indicator: Students will design and build a prototype of an effect or that will perform a specific task.

2.2 Objective: Learn about mechanical gears and energy transfer.

2.2.1 Performance Indicator: Students will be able to use a mechanism to change energy by transferring its direction, speed, type of movement, force or torque.

2.2.2 Performance Indicator: Students will design mechanisms that can be used individually, in pairs, or in systems.

2.2.3 Performance Indicator: Students will identify the differences between an open-loop system, which has no feedback path and requires human intervention, and a closed-loop system that uses feedback.

2.2.4 Performance Indicator: Students will work in teams using Fischertechnik equipment to build and program a work cell in a fully automated assembly line.

Energy and the Environment

Standard 3 – Students learn about the importance of energy in our lives and the impact that using energy has on the environment.

3.1 Objective: Learn about sources of energy.

3.1.1 Performance Indicator: Students will identify sources of energy used in our homes, schools, and factories, and explore ways to use these resources more efficiently.

- 3.1.2 Performance Indicator: Students will explain how human activities, particularly fossil fuel burning and deforestation, are affecting the environment.
- 3.1.3 Performance Indicator: Students will calculate the economic impact of various forms of energy usage.
- 3.2 Objective: Work in teams on a “government project” to develop alternative energy resources for a specific purpose.
 - 3.2.1 Performance Indicator: Students will conduct research on a specific dependency the nation has on coal, petroleum, or natural gas.
 - 3.2.2 Performance Indicator: Students will choose the best form of alternative energy to diminish this dependency.
 - 3.2.3 Performance Indicator: Students will present a two to three minute sales presentation about their proposal using PowerPoint or other media.
 - 3.2.4 Performance Indicator: Students will build a prototype or model of their solution.

Flight and Space

Standard 4 – Students explore the science behind aeronautics and use their knowledge to design, build, and test a model glider.

- 4.1 Objective: Learn about the evolution of flight.
 - 4.1.1 Performance Indicator: Students will research how aerospace vehicles were developed.
 - 4.1.2 Performance Indicator: Students will learn about the flying characteristics and safety precautions related to flying aerospace vehicles.
- 4.2 Objective: Research and test airfoil construction.
 - 4.2.1 Performance Indicator: Students will identify how forces including lift, gravity, thrust, and drag work on an airplane.
 - 4.2.2 Performance Indicator: Students will apply Bernoulli’s Principle to how an airfoil gets lift.
 - 4.2.3 Performance Indicator: Students will use the knowledge gained to build, test, and evaluate their own airfoil designs in a wind tunnel.

- 4.3 Objective: Learn how Newton's three laws of motion apply to propulsion systems.
- 4.3.1 Performance Indicator: Students will learn that an external force is required to change the state of an object from rest to motion and from motion to rest.
 - 4.3.2 Performance Indicator: Students will investigate the affect force and mass have on the acceleration of an object.
 - 4.3.3 Performance Indicator: Students will use Newton's third law of motion to explain the production of thrust by a propulsion system.
 - 4.3.4 Performance Indicator: Students will apply laws of motion to three principle propulsion systems – the propeller, the jet engine, and the rocket.
 - 4.3.4 Performance Indicator: Students will work in teams to compete against other teams to determine who can design a scooter that will propel the farthest.

The Science of Technology

Standard 5 – Students learn about applied physics, chemical engineering, and nanotechnology.

- 5.1 Objective: Learn about the mechanics of motion.
- 5.1.1 Performance Indicator: Students will identify where potential and kinetic energy are used in systems.
 - 5.1.2 Performance Indicator: Students will distinguish between open and closed systems designed by humans and found in nature.
 - 5.1.3 Performance Indicator: Students will identify the different types of simple machines and give examples of each.
 - 5.1.4 Performance Indicator: Students will work within a specific list of requirements to design and build a system that will deliver a marble from point A to point B.
- 5.2 Objective: Learn how energy can be changed from one form to another.
- 5.2.1 Performance Indicator: Students will research renewable and nonrenewable forms of energy.
 - 5.2.2 Performance Indicator: Students will research energy related careers.

- 5.2.3 Performance Indicator: Students will design a prototype and a scaled working model of a dragster or a magnetic levitation vehicle. They will then collect data on velocity, mass, and acceleration of the vehicles in the class.

Magic of Electronics

Standard 6 – Students explore the science of electricity the behavior of parts of atoms, circuit design, and sensing devices. Students acquire skills in basic circuitry design and explore the impact of electricity in our lives.

- 6.1 Objective: Learn about the different forms of electricity, and that different materials affect how electricity is produced and used.
 - 6.1.1 Performance Indicator: Students will build models that demonstrate static and current electricity.
 - 6.1.2 Performance Indicator: Students will use the periodic table to predict an element's electrical conductivity. They will then use a digital multimeter to test the material.
 - 6.1.3 Performance Indicator: Students will explore careers relating to electronics and to electrical engineering.
- 6.2 Objective: Learn about electromotive force.
 - 6.2.1 Performance Indicator: Students will explain how motors generate electromotive force through the use of electricity to do work.
 - 6.2.2 Performance Indicator: Students will identify the parts of an atom, their charges, and the roles they play in electromotive force.
 - 6.2.3 Performance Indicator: Students will build a model of a DC motor and troubleshoot its performance.
- 6.3 Objective: Learn about circuit design and fabrication.
 - 6.3.1 Performance Indicator: Students will identify standard symbols and read schematics used in designing circuitry.
 - 6.3.2 Performance Indicator: Students will assemble series, parallel, and combination circuits using bread boarding techniques. They will perform tests to prove or disprove Ohm's Law.
 - 6.3.3 Performance Indicator: Students will identify various resistors and determine the actual measurements using a multimeter.

- 6.3.4 Performance Indicator: Students will investigate transistors and semiconductors, and design routing diagrams for both.
- 6.3.5 Performance Indicator: Students will assemble a transistor light sensing circuit using printed circuit board material.
- 6.4 Objective: Learn how digital electronics provides a means to transfer messages between people and machines.
 - 6.4.1 Performance Indicator: Students will identify the source, encoder transmitter, receiver, and destination components in communication systems.
 - 6.4.2 Performance Indicator: Students will learn about the truth table associated with the AND, OR, XOR, and NOT gates.
 - 6.4.3 Performance Indicator: Students will solve a series of logic problems taken from everyday applications. They will build and test the solutions using electronic trainers.