

## **Tamalpais Union High School District**

**Larkspur, California**

**Course of Study**

### **Principles of Technology**

#### **I. INTRODUCTION**

##### **A. General Purpose**

The Principles of Technology course is a one semester practical, activity-oriented, laboratory-based program accessible for all students at all levels. It is an integrated curriculum encompassing knowledge and skills across technology systems. By participating in this program, students will be introduced to a wide variety of technologies that will form a foundation for career exploration in the career clusters of Construction Technology, Drafting Technology, Electronic Technology, Engineering Technology, Graphic Communication Technology, Manufacturing Technology, And Transportation and Energy Technology. The Principles of Technology course is intended to provide the basic skills needed for subsequent courses in these fields of industrial and Technology Education and post-secondary options.

In this class students will develop the foundation skills in critical thinking, creative problem solving techniques, and informed decision making through a sequence of modules and projects. These tasks will require personal persistence, collaboration with other students and the instructor, and research using a variety of methods, media and sources including the internet.

The course content will be cross-curricular involving applications from multiple disciplines. The course will require integration of academic skills involving joint efforts between the academic teachers and applied technology teachers. This course provides college bound students with concrete, hands-on applications of theoretical concepts learned in science and mathematics and provides essential preparation for advanced study.

The course content will be consistent with current industry standards and will involve collaboration with an advisory committee. Also, the course content will be aligned with related post-secondary programs at community colleges and universities so that 2+2+2 options are available for students who wish to continue in this field.

### **Credit**

This course will allow students to follow their interests in the modules that they select and to move at varying rates and depths within the modules. The class will be open entry allowing students to enter at various times during the semester. Credit for the course will be variable based on proficiencies demonstrated: each module will have a credit value and grades will be assigned by the proficiencies demonstrated. A talented student could complete more modules and earn more credit. Also, because many of the modules (Drafting, CADD, Multi-Media, etc.) will have an introductory and an advanced level, it is possible that some students could also earn more than 5 credit a semester in this manner.

### **B. Tam 2000 Goals and District Outcomes**

- Outcome 2 Read and analyze material in a variety of disciplines.
- Outcome 3 Use technology as a tool to access information, analyze and solve problems, and communicate ideas.
- Outcome 5 Apply mathematical knowledge and skills to analyze and solve problems.
- Outcome 6 Demonstrate scientific literacy.
- Outcome 7 Demonstrate a knowledge of the global environment and its resources.
- Outcome 9 Apply the principals of economics.
- Outcome 12 Demonstrate school-to-work/post-secondary transition skills and knowledge.

### **C. Articulation with Department and School**

The Principles of Technology course is a prerequisite for the Applied Technology courses that follow such as Construction Technology, Transportation Technology, Electronics and the upper level Drafting classes. Within the school, this course complements and reinforces knowledge of math, English and the sciences as well as provides a rich atmosphere in which to focus these skills in career related projects.

Students will see explicitly the theoretical and empirical bases as well as the practical and applicable aspects of their academic courses.

In addition, students will contextualize their learning by participating in activities that require a multi-view perspective of the knowledge that they have gained across curriculum.

### **D. Course Goals**

- Develop personal awareness towards safety and responsibility.
- Develop analytical skills by researching, defining and solving problems.

- Introduce cutting edge technologies that are reshaping business and the work force.
- Provide a hands on experience working with materials, tools and methods of industrial technology.
- Develop good workmanship habits and apply the principles of craftsmanship and use the standards of performance required by industry.
- Use appropriate tools, equipment, and supplies in a safe proficient and efficient manner.
- Listen, read and follow directions
- Participate as an effective member of a team including communicating ideas clearly in oral, written, and graphic form and organizing and sharing responsibility.
- Analyze the effects of industrial technology on natural resources using the life cycle analysis method.
- Explore Career options within technology fields.

## **II. STUDENT LEARNING OUTCOMES**

### **A. Outcomes**

Central organizers for this course include safety, career exploration, and principles of research and design. These concepts will be woven throughout all the modules. Each module will require students to complete a mini-project and there will be a culminating project required synthesizing several of the technologies.

#### **Modules**

Based upon teacher interests, skills and availability of equipment, each semester's course will offer students the opportunity to complete a number of these modules. Some will be required for all students; others will be options so students can pursue their own interests. As this course is intended to expose students to emerging technologies, there will be new modules added in the future and others dropped.

#### **Manual Drafting**

Students will:

- Review literature and study drawing exemplifying the basic concepts of graphic communication, including the basic skills, terminology and application of standard industrial drafting.
- Create drawings with the proper line usage, dimensioning, measuring, freehand sketching, orthographic and pictorial projection conventions of manual drafting.

#### **Computer Aided Drafting and Design**

Students will:

- Identify the components and their interrelationships in a CADD system. Identify some of the design possibilities of a CADD system including Mechanical and Architectural Design drawings and a 3-D Modeling.
- Use the basic commands of a CADD software program to create drawings. Organize drawings and apply appropriate software file-management procedures for the storing and retrieval of drawings.
- Produce a copy of a completed design drawing.

### **Construction Technology**

Students will:

- Identify the safety procedures for working in constructional;
- Identify and describe the basic tools, equipment and materials used in construction.
- Identify the basic components of residential and multi-family dwellings.
- Identify the basic steps involved in constructional.
- Identify the main sub-specialties involved in construction.
- Select and demonstrate safe and skillful use tools and machines in a variety of construction activities.
- Use the professional tolls applicable to the concepts of plumb, level, and square.
- Interpret blueprints and apply the information in basic planning and layout processes.
- Identify and apply a basic knowledge of the Buildings Codes applicable to wood frame construction.

### **Residential Wiring**

Students will:

- Identify the safety procedures for working with electricity.
- Apply a basic understanding of electricity including the flow of electrons and Ohms law in a project.
- Identify and describe the wires, cables, conduits and schematics used in residential wiring.
- Identify and describe the basic tools used in residential wiring.
- Describe the different types and uses of electrical components.
- Mounting and wire electrical components including 110 volt, 220 volt and low voltage applications.
- Identify and apply a basic knowledge of the Buildings Codes applicable to residential and light commercial wiring.

### **Residential Plumbing**

Students will:

- Identify the safety procedures for working with plumbing.
- Identify and describe the basic tools used in residential plumbing.
- Identify the different types of plumbing components and applications.

- Install plumbing components including copper pipe supply lines, and ABS drain, waste and vent lines.
- Identify and apply a basic knowledge of the Buildings Codes applicable to residential plumbing.

### **Sheet Metal**

Students will:

- Identify the safety procedures for working with sheet metal.
- Identify and describe the basic tools used in residential sheet metal.
- Identify the different types of sheet metal components and applications including HVAC, gutters and flashing, and specialty applications.
- Safely and properly use sheet metal forming and cutting tools and fasteners.
- Measurement and layout a small sheet metal project
- Design, layout, and construct a small sheet metal project
- Installation sheet metal components used in frame construction, including metal studs and metal framing components.
- Identify and apply a basic knowledge of the buildings Codes applicable to residential sheet metal construction.

### **Engineering Structures**

Students will:

- Analyze models, review problems and perform calculations based on the forces of stress (compression, tension, and shear) and how they affect different materials and relate to the design of structures.
- Identify the basic building components that require stress analysis.
- Design, construct, and test a basic building component such as a roof truss or a bridge structures.

### **Project Management**

Students will:

- Use, in the creation of a model project, the major components of Project Management including Supervision, Estimating, Scheduling, Construction Documents, Construction Law, Building Codes, and Safety Management.
- Estimate the materials, labor, development costs and overhead of a project using a spreadsheet software program on a computer.
- Schedule the sequence of events and interrelationships of activities relevant to a specific project using a scheduling software program on a computer.
- Maintain a list of the materials, suppliers, and participants in a project on a database software program on a computer.
- Set up an Illness and Injury Prevention Program (IIPP) following the guidelines established by OSHA.

### **Principles of Measurement**

Students will:

- Use and convert Metric, American Standard, and Decimal measurements.

- Perform calculations with linear, two dimensional, and volumetric measurements.
- Perform mathematical calculations using whole numbers, fractions, decimals, etc.
- Calculate volume, area and distance in selected problems of industrial technology.
- Use the mathematical processes of algebra, geometry, and trigonometry in the solution of problems in industrial technology.
- Identify and accurately use various measurement instruments including a tape measure, micrometer, vernier caliper, dial caliper, thickness gage, etc.
- Calibrate and state the tolerances of the various measurement instruments.

### **Multi-Media: Photography, Sound, Video, and Graphic Arts**

Students will:

- Produce a multimedia presentation, integrating photography, video, audio, graphics and text.
- Use the equipment and the software programs that generate multi-media productions.

### **Aerospace Technology**

Students will:

- Explore the history of flight & aviation through the use of text, videos and study questions.
- Learn to control a light aircraft using computer flight simulation software.
- Demonstrate navigation skills
- Read and interpret aircraft instruments
- Interpret a sectional map.
- Plan a flight, calculate distance, time and fuel.
- Execute successful takeoffs and landings.
- Achieve and maintain designated headings and altitudes.

### **Simple Machines**

Students will:

- Explore the basic principles of simple machines through the use of text, videos and study questions.
- Students will identify three different simple machines in their home and describe their function.

### **Pneumatics**

Students will:

- Learn about pneumatic devices by using an air supply, pressure gauges, regulators, pneumatic switches and one way valves to create simple logic circuits.
- View written material and videos to show how these components are used in the manufacturing industry and in vehicle brakes.

## **Hydraulics**

Students will:

- Learn about hydraulic devices by rebuilding and testing a brake master cylinder and a wheel cylinder connected as system.
- View written material and videos to see how these components are used in the manufacturing industry and in vehicle brakes.

## **Gears, Gear Ratios, and Power Transfer**

Students Will:

- Learn about gears and gear ratios by tearing down and rebuilding a manual transmission.
- View written material and videos that will exemplify the engineering of a transmission.

## **Radio Communications**

Students will:

- Learn about the history of radio and the use of radio technology in other devices through written material and video.
- Describe and identify radio components such as a transistor and capacitor.
- Describe and construct the discrete circuits that make up a radio.

## **Electronics**

Students will:

- Explore the basic principals of electricity and electronics and their components through written material and video.
- Generate some electricity with an alternator and describe how it was made in a written paper with illustrations.
- Understand electrical resistance and Ohm's law by calculating the properties of the circuits they build.
- Build a series circuit.
- Build a parallel circuit.
- Build a series/parallel circuit and correctly use digital and analog multimeters to establish its properties.

## **Electronic Control Systems**

Students will

- Learn how a computer takes in inputs from electrical sensors and then process the information for an out put response by examining the fuel delivery system of a fuel-injected car.
- Explore input sensors that measure: temperature, pressure, oxygen, airflow etc. through written material, video and disassembly of before mentioned components.
- Explore output devices such as servos, solenoids and switches through written material, video and disassembly of before mentioned components.

### **Small Gas Engines**

Students will:

- Explore the use and operation of small gas engines through written material and video.
- Understand the principles of four stroke and two stroke motors and be able to demonstrate this understanding by diagnosing hypothetical engine problems.
- Explain how a piston, rod, and crankshaft change linear motion to rotary motion in a written paper.
- Use inside and outside micrometers to measure wear of components.
- Tear down and rebuild a small gas engine to running condition.

### **Metals: Cutting, Welding, Machining**

Students will:

- Explore the chemical, physical, and mechanical properties of welding materials and how welding processes affect those properties through written and video material.
- Use in a safe manner the oxyfuel welding processes and equipment to form, separate, and combine metals.
- Use in a safe manner the oxyfuel process of forging, flame cutting, brazing, soldering, and welding to repair and produce, parts and products.
- Use in a safe manner the arc welding process and equipment to form, separate and combine metals.
- Use in a safe manner the arc welding process and equipment to form, separate, and combine metals.
- Use in a safe manner the arc welding process to repair and produce parts and products.

### **Transportation Technology**

Students will:

- Learn to see the modern automobile as a collection of systems by reading and viewing material on each specific system.
- Identify the components and their function with in one of the automotive systems on a diagram.
- Use a flat rate manual to write a legal repair order.
- Use a repair manual to identify the proper maintenance and tune-up of an automobile
- Use flow charts to logically diagnose an automotive drivability problem.

### **B. Means of Student Assessment**

Student assessment in this course will strive to replicate the work place environment with weight given for punctuality, preparedness and self-direction. Portfolios, projects, papers, journals, notebooks, tests, and team assessment are

some of the possible assessment tools to be employed by individual teachers as is appropriate. Students will be given the course outcomes and a description of the methods of assessment and grading in writing at the beginning of the semester.

C. **Course Assessment**

This class will be assessed by the students, administrators and staff of the Tamalpais High School district through observations and surveys. Additional input will be solicited from members of the Advisory Committee.

III. **METHODS AND MATERIALS**

The methods and materials utilized in the Principles of Technology course will be a combination of industry-provided modules in areas such as robotics, electronics, aerodynamics, as well as work stations with projects introducing skills in drafting, carpentry, welding, machining, and electrical work. Etc. The students will follow the research and development process of building and analyzing of prototypes, using the tools, methods, technical skills and knowledge of the related industry. The number and type of modules will be determined by the availability of time, space, resources and staff.

This lab will be designed as a self-paced journey that will take students from one module to the next during which skills will be build and integrated providing the students with basic skills and opening the door for them

IV. **GENERAL INFORMATION**

A. **Prerequisites**

There are no prerequisites for this class. It is open for all students at all levels. It will be considered as a prerequisite for drafting, construction, electronics, and automotive technologies, and other courses to be developed in the future that provide a second level of focus on any of the career clusters. This class would be a good resource for senior projects.

B. **Graduation Requirements**

This class fulfills up to a maximum of one semester (5 units) of elective credit for graduation. Under special circumstances described earlier, it might be possible for a student to accrue more than 5 units.

C. **U.C. Requirements**

None

Adopted: 1/13/97