

Challenge Standards for Student Success

# Industrial and Technology Education

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# Table of Contents

<b>TABLE OF CONTENTS.....</b>	<b>I</b>
<b>INTRODUCTION .....</b>	<b>II</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>V</b>
 <b>HIGH SCHOOL CONTENT STANDARDS</b>	
<b>TECHNOLOGY CORE.....</b>	<b>1</b>
<b>CONSTRUCTION TECHNOLOGY.....</b>	<b>4</b>
<b>DRAFTING TECHNOLOGY .....</b>	<b>7</b>
<b>ELECTRONICS TECHNOLOGY .....</b>	<b>9</b>
<b>ENGINEERING TECHNOLOGY.....</b>	<b>12</b>
<b>GRAPHIC COMMUNICATIONS TECHNOLOGY .....</b>	<b>15</b>
<b>MANUFACTURING TECHNOLOGY .....</b>	<b>19</b>
<b>TRANSPORTATION &amp; ENERGY TECHNOLOGY .....</b>	<b>21</b>
 <b>RESOURCES</b>	
<b>WEB SITES .....</b>	<b>28</b>
<b>SELECTED PUBLICATIONS .....</b>	<b>29</b>

# INTRODUCTION

## Challenge Content Standards for Student Success

*Challenge Content Standards for Student Success: Industrial and Technology Education* is a compilation of core standards from within the Industrial and Technology Education content areas of:

- \$ Technology Core
- \$ Construction Technology
- \$ Drafting Technology
- \$ Electronics Technology
- \$ Engineering Technology
- \$ Graphic Communications Technology
- \$ Manufacturing Technology
- \$ Transportation & Energy Technology

These Challenge Content Standards describe the basic or core content that students are expected to learn in each of the above curriculum subject disciplines. You will notice that this publication identifies only the core standards for each curriculum discipline. These are the standards that are used in the development of the *Assessment of Career Education (ACE)* tests for the disciplines within Industrial and Technology Education in California. **A comprehensive set of Industrial and Technology Education performance standards** may be found in the *Industrial and Technology Education Career Path Guide and Model Curriculum Standards, 1996* published by the California Department of Education.

## Industrial & Technology Education - An Overview

Industrial and Technology Education (ITE) in California is a kindergarten through university continuum of well-planned, coordinated, articulated, integrated and sequential learning experiences. These experiences prepare students for successful transition to the work place, and further success in the home, community, and the pursuit of lifelong learning.

Industrial and Technology Education subjects form a powerful and positive linkage with all other disciplines. Knowledge and skills across disciplines are enhanced and reinforced enabling students to compete in our economy as productive citizens. These ITE disciplines are provided within the context of a total sequential program, wherein a student will be able to plan intelligently and properly prepare for a career goal.

ITE disciplines are designed to provide students with the skills, knowledge, and attitudes necessary to help them gain employment or advanced training in the career field of their choice and the ability to work with the changing technologies of the future. This interdisciplinary approach provides students with strong foundation and advanced level skills in their career field, and options as they pursue entry level and advanced employment or continued education.

## Industrial and Technology Education - A Curriculum Continuum

Industrial and Technology Education course sequences are integrated with career performance standards and related competencies in mathematics, science, communications (English/language arts), history and social sciences to develop Industrial and Technology Education Career Majors at both the secondary and post-secondary levels.

The Industrial and Technology Education (ITE) Continuum (see figure 1) identifies key goals, educational levels and delivery systems. These components are defined by related performance standards describing what students will understand and be able to do. Performance standards for any of the key ITE continuum elements are used to develop related courses and course sequences. Students begin their ITE continuum in an *Elementary School Awareness Program*. The program activities are designed to enhance and reinforce the attainment of educational goals of the total elementary curriculum.

Middle school students enjoy *Exploring Technology Education* courses, which are broad-based, modularized curriculum, which offer integrated, active, and cognitive development activities.

Figure 1 High school students entering *Technology Core* courses find an integrated curriculum reflecting four characteristics: broad based knowledge, heavy involvement with computers, rapidly changing technical content, and a systems oriented emphasis.

Individual interests in specific **career majors** lead high school students into rigorous, concept-driven courses wherein they participate in focused activities and develop a knowledge base that helps them to make sound career choices. Pursuing a career major, high school students enter occupational specific courses. Meeting career major competencies enables students to enter into the workforce at any one or combination of three completion points; from high school graduation and into entry level skilled careers, from community college certification, licensure and/or graduation and into technician/supervisor careers, and from university certification, licensure and/or graduation and into professional/managerial careers. Other opportunities for career development are available through apprenticeship programs.

A major secondary/postsecondary option for students pursuing a career major is *Tech Prep*. Tech Prep in California is a technology based instructional, management, and counseling approach to prepare students in advanced technologies. It represents a course of study that integrates college preparatory course work with a rigorous technical education. In addition to the Tech Prep approach, many schools offer similar programs under the titles of 2+2, 2+2+2, partnership academies, magnet schools, charter schools and learning communities. All of these coordinated sequential programs are organized to assist the students in moving from one level of education to another and attaining a degree or advanced degree in their area of interest. This Industrial and Technology Education concept driven curriculum is derived from and linked to performance standards developed and published by the California Department of Education in the *Industrial and Technology Education Career Path Guide and Model Curriculum Standards, 1996*. These process-based performance standards describe what the student understands and will be able to do in the 21<sup>st</sup> century-helping students connect what they learn in class to the outside world.

Through an interdisciplinary model exemplified by collaborative performance activities, Industrial and Technology Education disciplines form a positive bond between the technical disciplines and the academic disciplines. These programs integrate themes and concepts, both within and across disciplines. Learning activities include complex concepts that require students to apply skills across subject matter boundaries reflecting the real-world context in which they are required. This collaboration helps students feel connected vocationally, academically, socially, and emotionally to other students and adults.

Students learn mathematics, science, and communication skills, history, and social science concepts through an activity-oriented approach. They learn to communicate effectively, solve problems, and present oral and written reports. This integrated linkage of technical and academic skills prepares high school students for enrollment in advanced academic, vocational, and technical courses at all educational levels.

Students develop leadership skills through participation in a formal career-technical student organization (CTSO) and other school/community activities. Personal and interpersonal skills are refined as students develop their leadership potential. Students working cooperatively share responsibilities and assume leadership roles while working as part of a team. This assists them to develop cooperative working relationships across gender and cultural groups. Through the use of communication, thinking, and problem solving skills, they learn to resolve personal and group issues in a dynamic setting.

Industrial and Technology Education subject area disciplines are beneficial for all students, including language minority students and those at risk of failure. A variety of strategies engage all students in the learning process and provides each student with a personalized learning experience. The concept of integration and support encompasses the notion that all students can learn and that a diverse student body has varied needs for support.

The complexity of advancing technology and the dynamics of change are creating new challenges for students entering the workplace. These changes also require continued upgrading and retraining. The worker of today and the future must understand essential technical concepts; scientific principles, mathematical concepts and communication skills upon which work is based and careers are successfully pursued. Students will benefit from active participation in an Industrial and Technology Education curriculum continuum which allows them to use their knowledge, skills, and experience to adapt as technology and the work place change. The high school standards described in this document comprise the **core standards** for each of the subject area disciplines in the Industrial and Technology Education continuum.

## ACKNOWLEDGMENTS

The planning, development, validation, and refinement of standards for the eight different disciplines of the Industrial and Technology Education Programs started in 1983. This effort resulted in the publication of the *Model Curriculum Standards, Program Framework, and Process Guide for Industrial and Technology Education Career Path and Model Curriculum Standards*, and subsequently the *Industrial and Technology Education Career Path Guide and Model Curriculum Standards*, 1996. These documents reflect the original and ongoing efforts of Industrial and Technology Education professionals, and partners from business and industry. More than 2,000 representatives from all educational levels, including colleges and universities, as well as continuing participation by the representatives from business and industry, have contributed to the development of general standards. The validation and refinement phase of these standards took place in hundreds of school sites, regional workshops, statewide conferences, and business and industry association meetings. The Industrial and Technology Education profession owes a great debt of gratitude to those who have contributed to the development of those standards. They provide an excellent set of guidelines for curriculum and course development.

The *Challenge Content Standards* describe the basic core content that students are expected to learn in each of the eight disciplines within the Industrial and Technology Education offerings. These challenge standards identifies only the core standards for each curriculum discipline. Many fine educators and friends of the profession helped in the development and writing of the challenge standards. Among them are the following:

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**Colleen Hill**, Center for Technology Education, Los Angeles  
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**Ray Martin**, State Center Consortium, Fresno  
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**Linda Matzek**, Center for Technology Education, Los Angeles  
**Robert McCarroll**, San Clemente High School, San Clemente  
**Paul McKillop**, El Rancho High School, Pico Rivera  
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**Chuck Minear**, Downey Unified School District, Downey  
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**Kevin Pendergast**, South El Monte High School, South El Monte  
**Kenneth Phillips**, Center for Technology Education, Los Angeles  
**Ron Pope**, Chico High, Chico  
**Robert Ransome**, Delta Sierra Middle School, Stockton  
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**Chuck Rockwood**, Ventura College, Ventura  
**Nelson Rodriguez**, South El Monte High School, South El Monte  
**Ron Rose**, Clovis High School, Clovis  
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**Teri Tsosie**, Hermosa Beach City School District, Hermosa Beach  
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**Tom Vessella**, Glendale High School, Glendale  
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# Technology Core

The Technology Core is designed to ensure that high school students have a broad knowledge base in the application of technological concepts and the adaptability needed to function efficiently in our technological society. Technology Core curriculum activities are designed to help all students develop problem solving skills, work collaboratively in teams, think independently, become responsible for their own learning, have safe and effective work habits, function in an ever-changing society, set high career goals, and develop career awareness and career paths.

Technological literacy is essential for all students so that they can understand the nature of technology, appropriately use technological devices and processes, including computer applications, and participate in society's decisions on technological issues. Technology classes lead students to understand the major technological concepts behind current issues and to develop skills in the safe use of the technological processes that are lifelong prerequisites for their careers, health, and enjoyment. Technologically literate students have the ability to use concepts from science, math, social studies, and humanities as tools for understanding and managing technological systems. Learning experiences and hands-on activities are offered in a wide variety of technology systems and strategies, such as; hydraulic, pneumatic, chemical, electromagnetic, optic, genetic, environmental, digital, electronic, mechanical, thermal, problem solving and others. The Technology Core Standards, which follow, are basic and integral to all technology core courses.

## **Standard 1: Design Processes**

Students will implement design processes in the research, planning, management and presentation of a design solution by designing and making devices and hybrid systems that solve complex real-world problems in a minimum of two of the following areas: communication, manufacturing, construction, transportation and energy, computers, and/or bio-related technologies. They will demonstrate content proficiency by:

- 1.1 Identifying and defining the problem
- 1.2 Developing a design brief that states the problem(s)
- 1.3 Specifying the desired results to be achieved
- 1.4 Using research techniques to support design brief development
- 1.5 Developing concept sketches
- 1.6 Stating the design constraints after reviewing research input
- 1.7 Developing and assess alternative design solutions
- 1.8 Selecting and finalizing the solutions and completing a working drawing (i.e. Mechanical, CAD, freehand drawings)
- 1.9 Using appropriate materials, tools, and processes to fabricate a model (form) of the solution
- 1.10 Testing model as appropriate
- 1.11 Developing a working model (function) and/or prototype
- 1.12 Testing and evaluating the working model and/or prototype
- 1.13 Presenting the product orally, graphically, and/or electronically
- 1.14 Adding product and support material to portfolio
- 1.15 Understanding concepts relating to copyright, trademark, and patent laws
- 1.16 Developing alternative plans for redesigning devices and systems
- 1.17 Considering design specifications and constraints by balancing needs, the availability of resources, and environmental impacts

## **Standard 2: Systems Thinking**

Students will understand and apply the universal technology systems model (input, process, output, and feedback) in a minimum of two of the following areas: communication, manufacturing, construction, transportation and energy, computers, or bio-related technologies.

They will demonstrate content proficiency by:

- 2.1 Explaining the function(s) of each of the following elements of technological systems; inputs, processes, outputs, and feedback
- 2.2 Producing and analyzing various technological systems and identify the ways in which they are controlled to produce a desired outcome
- 2.3 Predicting and explaining the differences between expected/unexpected and desirable/undesirable outputs
- 2.4 Demonstrating how feedback can improve the way a system works
- 2.5 Illustrating how systems are planned, designed, constructed, and applied to perform a task
- 2.6 Identifying a systems problem and generating a solution

## **Standard 3: Resources in Technology**

Students will be able to complete a technological activity by selecting, applying and managing resources (people, information, materials, tools and machines, energy, capital, and time) in a minimum of two of the following areas: communication, manufacturing, construction, transportation and energy, computers, or bio-related technologies. They will demonstrate content proficiency by:

- 3.1 Comparing and contrasting at least two forms of renewable, limited, and unlimited energy resources
- 3.2 Researching two different occupational roles found in a technological system
- 3.3 Explaining how time has been utilized throughout history to manage specific technological systems
- 3.4 Demonstrating the function of particular tools or machines used in specific technological systems
- 3.5 Applying natural materials and/or synthetic materials in the process of a technological activity
- 3.6 Evaluating the role of capital in technological systems
- 3.7 Illustrating how information is used to solve technological problems
- 3.8 Utilizing all relevant and necessary resources to solve a given technological problem

## **Standard 4: Technology and Society**

Students will understand the impact that technological advances and society have on each other and will demonstrate this understanding in a minimum of two of the following areas: communication, manufacturing, construction, transportation and energy, computers, or bio-related technologies. They will demonstrate content proficiency by:

- 4.1 Describing why technological advances may have both desirable and undesirable impacts on society
- 4.2 Describing the effects technological advances have on the development of societies
- 4.3 Interpreting the impacts of technological advances on the environment
- 4.4 Discussing the impacts of technological advances and cultural norms/customs on each other

- 4.5 Analyzing how technological advances affect local, national and global economies
- 4.6 Evaluating the impacts of technological advances on national and international political systems
- 4.7 Explaining the interface between technological advances and human ethics
- 4.8 Describing how humans are faced with moral and ethical issues because technology is enabling very significant modifications of the natural world
- 4.9 Discussing societies' ability/inability to control the technologies they have created
- 4.10 Projecting and forecasting the development of future technological needs and uses

# Construction Technology Core

The Construction Technology Career Major prepares an individual for employment or advanced training in a variety of construction-related industries. This major prepares individuals to enter the workforce as skilled workers, technicians, supervisors, and managers.

The Career Major sequence of courses is tailored to each student's goal by providing the student the opportunity to enroll in such specialty courses as carpentry; construction equipment operation; furniture making; heating, ventilating, and air conditioning; masonry; plumbing; electrical wiring; millwork; cabinetmaking; surveying; and construction management. The Construction Technology Core Standards which follow are basic and integral to all courses in the Career Major.

## **Standard 1: Measurement/Math Applications**

Students will understand and apply measurement systems in the planning and layout processes used in the construction industry. They will demonstrate content proficiency by:

- 1.1 designing solutions to given construction technology problems
- 1.2 accurately measuring given construction materials for processing
- 1.3 using measurements to calculate material requirements
- 1.4 converting scale drawing measurements to full dimensions
- 1.5 converting measurements from one form to another

## **Standard 2: Hand Tools**

Students will understand safe and appropriate use of hand tools common to the construction industry (hammers, pliers, saws, wrenches, etc.). They will demonstrate content proficiency by:

- 2.1 identifying tools commonly used in specific trades
- 2.2 correctly using tools in their intended application
- 2.3 demonstrating basic care and maintenance of hand tools

## **Standard 3: Portable Power Tools**

Students will understand safe and appropriate use of portable power tools common to the construction industry. They will demonstrate content proficiency by:

- 3.1 identifying and correctly using drill motors (portable circular saws, reciprocating saws, pneumatic nailers, screw guns, and grinders)
- 3.2 demonstrating basic care and maintenance of portable power tools

## **Standard 4: Construction Business Processes**

Students will understand procedures and processes as they occur in the construction industry. They will demonstrate content proficiency by:

- 4.1 estimating materials using blueprints and specifications
- 4.2 constructing projects accurately from blueprints and specifications
- 4.3 planning a sequence of events in a construction project
- 4.5 solving common construction problems using construction codes and building standards
- 4.6 keeping accurate records of construction progress

**Standard 5: Construction Project Phases/Systems**

Students will understand the variety of building phases/systems used in construction projects. They will demonstrate content proficiency by:

- 5.1 developing a building plan utilizing given systems common to construction projects
- 5.2 using tools, processes, and materials appropriate to architectural design and development of construction projects
- 5.3 using tools, processes, and materials appropriate to site development in construction projects
- 5.4 using tools, processes, and materials appropriate to structural systems in construction projects
- 5.5 using tools, processes, and materials appropriate to electrical systems in construction projects
- 5.6 using tools, processes, and materials appropriate to mechanical systems in construction projects
- 5.7 using tools, processes, and materials appropriate to finish systems in construction projects

**Standard 6: Safety**

Students will understand the value and necessity of practicing occupational safety in the construction industry. They will demonstrate content proficiency by:

- 6.1 passing required safety tests
- 6.2 demonstrating the safe use of hand tools and power tools
- 6.3 explaining the roles and responsibilities of the various governmental safety agencies
- 6.4 using safe work practices
- 6.5 receiving exposure/training in CPR and basic first aid

**Standard 7: Industry Trends**

Students will understand the impact of financial, technical, and environmental trends on the past and future of the construction industry. They will demonstrate content proficiency by:

- 7.1 researching given current trends in the construction industry and predicting future impacts on these segments of the industry
- 7.2 developing plans to creatively finance a given project in the construction industry
- 7.3 developing a report or conducting a study on environmental regulations and their impact on construction projects/practices
- 7.4 studying the impact of the historical development of construction processes and their impact on the construction industry

**Standard 8: Career Preparation and Planning**

Students will understand career preparation and how it applies across all standards for students planning to successfully enter and advance in the construction industry. They will demonstrate content proficiency by developing:

- 8.1 personal skills – exhibit positive attitudes, self confidence, honesty, perseverance, self-discipline (dependable, reliable, punctual, etc.) and personal hygiene; manage time and balance priorities to demonstrate capacity for life-long learning
- 8.2 interpersonal skills – work cooperatively with others, share responsibilities, accept supervision and assume leadership roles; demonstrate cooperative working relationships across gender and cultural groups

- 8.3 thinking and problem solving skills – recognize problem situations; identify, locate, and organize needed information or data; propose, evaluate, and select from alternative solutions
- 8.4 communication skills – communicate both orally and in writing; listen attentively and follow instructions, requesting clarification or additional information as needed
- 8.5 employment literacy skills – promote the role of the construction industry in a productive society and the purpose of professional organizations; develop a plan for professional growth across all aspects of the industry, including financial, leadership, and advancement elements
- 8.6 a career plan – explore options for future learning and employment, including apprenticeship, community college, university, internship, and other training programs

# Drafting Technology Core

The Drafting Technology Career Major prepares an individual for employment or advanced training in a variety of industries. Drafting education prepares students to plan, design and prepare mechanical, architectural, structural, electrical, topographic and other drawings for use by designers, engineers, planners and many others.

The Drafting Technology Core Standards are basic and integral to all drafting-related courses. They establish a foundation in fundamental drafting operations which can be applied to a variety of design modalities.

## **Standard 1: Drafting Fundamentals**

Students will understand concepts of basic drafting that include measurement, lettering, sketching, and dimensioning practices. They will measure accurately, apply appropriate lettering techniques and fonts when creating drawings, produce well-proportioned and easily understood two and three dimensional sketches, and apply dimensioning practices for drawings using the current standards of dimensioning and tolerancing for a variety of drafting applications. They will demonstrate content proficiency by:

- 1.1 using scales (architects, metric, civil, and mechanical)
- 1.2 using drafting equipment
- 1.3 using common symbols and abbreviations
- 1.4 demonstrating lettering styles
- 1.5 performing freehand lettering
- 1.6 sketching a drawing
- 1.7 applying basic dimension techniques
- 1.8 applying tolerancing
- 1.9 using proper layout techniques

## **Standard 2: Orthographic Drawing**

Students will understand, identify and correctly use the alphabet of lines, and will represent objects graphically using appropriate projection techniques. They will demonstrate content proficiency by:

- 2.1 properly using the six principle views to fully describe an object
- 2.2 demonstrating the process of projection
- 2.3 differentiating line drawing procedure/priority

## **Standard 3: Sectioning**

Students will understand section view applications/functions, and will incorporate section views and appropriate cutting planes to clarify hidden features or objects on drawings. They will demonstrate content proficiency by:

- 3.1 using sectional line conventions and symbols
- 3.2 drawing full sections and half sections

## **Standard 4: Primary Auxiliary**

Students will understand primary auxiliary projections, and will use orthographic projection methods to produce primary auxiliary views. They will demonstrate content proficiency by:

- 4.1 constructing an auxiliary view from an oblique plane

**Standard 5: Pictorial Drawing**

Students will understand the structure, types, sequential construction methods, and applications of pictorial drawings, and will draw objects accurately in pictorial format. They will demonstrate content proficiency by:

- 5.1 producing isometric drawings
- 5.2 producing oblique drawings
- 5.3 producing perspective drawings

**Standard 6: Computer-Aided Drafting (CAD) and Operations**

Students will understand how to use the appropriate hardware and software to create geometry and apply dimensioning practices to complete drawings. Drawings will be organized using accepted computer aided drafting (CAD) procedures. They will apply appropriate software file-management procedures, and will produce hard copies of the completed drawings and save electronic files. They will demonstrate content proficiency by:

- 6.1 operating Computer Aided Drafting (CAD) equipment
- 6.2 applying CAD software to generate drawings
- 6.3 saving and retrieving drawing files

**Standard 7: Research and Design**

Students will understand and incorporate research and design strategies as they relate to the universal problem-solving approach in the development of a drawing for the construction of a project. They will demonstrate content proficiency by:

- 7.1 determining client needs
- 7.2 developing a design for a manufacturing and/or construction project to meet a client's needs
- 7.3 evaluating the product in light of its function and meeting the client's needs

**Standard 8: Solid Modeling**

Students will understand the physical categories of solid geometry, and will generate a solid model using primitive shapes, extrusions and revolutions. Students will form solid models by joining primitives and solids formed by extrusion and revolution using union, difference and intersection. They will demonstrate content proficiency by:

- 8.1 producing three-dimensional drawings of polyhedral, prisms, cylinders, pyramids, cones, spheres, torus, and ellipsoids
- 8.2 producing models using primitive shapes

**Standard 9: Working Drawings**

Students will understand concepts of working drawings and produce drawings for manufacturing. They will demonstrate content proficiency by:

- 9.1 completing the various types of working drawings using appropriate line work, symbology, and current standards
- 9.2 applying correct tolerance conventions to drawings
- 9.3 developing primary orthographic and auxiliary views
- 9.4 organizing and completing an assembly drawing using information collected from detail drawings

# Electronics Technology Core

The Electronic Technology Career Major prepares an individual for employment or advanced training in a variety of electronic industries. This major prepares individuals to work as technicians, engineers, and professionals who perform research and design, manufacturing, maintenance and service functions.

The Career Major sequence of courses includes theory; underlying physical science and mathematics; equipment, including electronic and mechanical devices and test equipment; and analog and digital circuitry. The Electronic Technology Core Standards which follow are basic and integral to all courses in the Career Major.

## **Standard 1: Safety**

Students will understand requirements of personal and equipment safety in the working environment. They will demonstrate content proficiency by:

- 1.1 Passing a written safety test
- 1.2 Creating a safety checklist
- 1.3 Helping to develop safety policies based on classroom events and observations
- 1.4 Completing tasks while maintaining a safe environment

## **Standard 2: History of Electricity and Electronics**

The student will understand the historical developments in electricity and electronics. They will demonstrate content proficiency by:

- 2.1 Creating a time line that depicts developments in technology
- 2.3 Explaining the major events of historical developments as they relate to current technology

## **Standard 3: Units of Measure:**

Students will understand the use of electronic test equipment and units of measure. They will demonstrate content proficiency by:

- 3.1 Selecting and applying appropriate equipment or tools
- 3.2 Analyzing and applying observed measurements
- 3.3 Utilizing engineering notation in unit conversion

## **Standard 4: Mathematics for Electronics**

Students will understand the mathematical processes and applications that lead to solutions of electronic problems. They will demonstrate content proficiency by:

- 4.1 Solving Direct-Current (DC) circuit analysis problems using Ohm's Law
- 4.2 Calculating fundamental Alternating Current (AC) parameters
- 4.3 Manipulating scientific notation in problem solutions
- 4.5 Manipulating engineering notation in problem solutions
- 4.6 Deriving algebraic equations to determine unknown values in circuits
- 4.7 Utilizing a scientific calculator as a tool for problem solving
- 4.8 Solving multi-step problems including word problems using linear equations in one variable

**Standard 5: Science of Electricity and Electronics**

Students will understand fundamental scientific principles involved in electricity and electronics. They will demonstrate content proficiency by:

- 5.1 Describing the relationships between atomic structure of the atom, electricity, electronics and the periodic table of elements
- 5.2 Clarifying the differences between conventional theory and electron theory
- 5.3 Defining the Laws of Charges and Magnetism
- 5.4 Completing a project incorporating the conductive and insulative properties of electron flow
- 5.6 Converting electricity from friction, chemical, solar, pressure, mechanical (magnetism), and thermal sources
- 5.7 Explaining the differences between electron flow and hole flow as it occurs in semiconductor materials

**Standard 6: Electronic Components**

Students will discern characteristics of commonly used electronic components. They will demonstrate content proficiency by:

- 6.1 Identifying symbols and component characteristics
- 6.2 Determining resistor's values by identifying color codes
- 6.3 Drawing schematic diagrams
- 6.4 Using diagrams to interpret circuit characteristics
- 6.5 Utilizing cross-reference resources

**Standard 7: Direct-Current (DC) Circuits**

The students will understand relationships between voltage, current, resistance and power as pertaining to direct-current circuits. They will demonstrate content proficiency by:

- 7.1 Calculating solutions to Ohm's Law problems
- 7.2 Constructing and measuring sample DC circuits
- 7.3 Comparing predicted outcomes to measured outcomes with lab activities
- 7.4 Analyzing data gathered from simple and complex DC circuits

**Standard 8: Alternating-Current (AC) Circuits**

The students will understand the theory of alternating current. They will demonstrate content proficiency by:

- 8.1 Defining the terms and measurements associated with an AC sine Wave
- 8.2 Using an oscilloscope to observe a sine wave to calculate pertinent Values
- 8.3 Comparing an oscilloscope measurement of a sine wave to measurements made by other instruments

**Standard 9: Introduction to Digital Electronics**

The students will understand fundamental concepts of digital electronics. They will demonstrate content proficiency by:

- 9.1 Drawing and labeling the seven basic logic gates
- 9.2 Deriving the truth tables of the seven basic logic gates
- 9.3 Constructing logic circuits using discrete components to emulate the seven basic gates

**Standard 10: Electronic Assembly**

The students will understand the procedures and processes related to electronic assembly. They will demonstrate content proficiency by:

- 10.1 Constructing an electronic device following a schematic diagram as a sole reference
- 10.2 Demonstrating the ability to use soldering techniques
- 10.3 Identifying tools commonly used in the electronic assembly
- 10.4 Using tools for their intended applications

**Standard 11: Employability Skills**

The students will understand how the development of personal skills affects their employability.

They will demonstrate content proficiency by:

- 11.1 Exhibiting positive attitudes, self-confidence, honesty, perseverance, self-discipline, and personal hygiene
- 11.2 Researching and identifying career paths and strategies for obtaining employment
- 11.3 Applying the principles of effective communication to convey and obtain information
- 11.4 Exhibiting critical and creative logical reasoning and problem solving skills

# Engineering Technology Core

The Engineering Technology career pathway prepares an individual for employment or advanced education and training in variety of industries that require the application of scientific, mathematical and engineering knowledge in combination with technical skills. This pathway prepares students to enter the workforce in four general engineering environments: chemical, electrical, civil and mechanical. Employment and education are available at the entry, technical (Associate Degree), and professional (Baccalaureate) levels.

The Engineering Technology core courses develop an understanding of processes, materials, systems and human factors associated with the development and use of technology. The Engineering Technology Core Standards which follow are basic and integral to the secondary education level of preparation for this career pathway.

## **Standard 1: Overview of Engineering**

Students will understand that engineering is solving problems by applying principles of mathematics, science, and technology. Students will solve problems using common engineering practices. Students will be acquainted with the major fields of engineering and with the diverse work functions that engineers perform. Students will understand that engineers have a moral obligation to the public. Students will be familiar with the paths and certifications that can lead to careers in engineering and engineering technology. They may demonstrate content proficiency by:

- 1.1 Selecting several major fields of engineering and gives a brief description of each
- 1.2 Listing several functions an engineer might perform in a particular Industry
- 1.3 Describing the level of education typically required to be an engineer or engineering technician
- 1.4 Giving possible courses of action and likely outcomes of situations where a decision involving ethics is required

## **Standard 2: Design Process/Problem Solving**

Students will understand the design process and how to solve analysis and design problems. They may demonstrate content proficiency by:

- 2.1 Identifying the principles that are relevant to a problem
- 2.2 Outlining the steps in the design process
- 2.3 Determining what known information is relevant to a problem and analyzes options for the solution of the engineering problem
- 2.4 Choosing between alternate solutions and develop the details to justify the choice
- 2.5 Translating word problems into mathematical statements when appropriate
- 2.6 Developing the details of one solution
- 2.7 Building a prototype from plans
- 2.8 Testing the prototype
- 2.9 Redesigning a prototype based on test data

## **Standard 3: Manufacturing**

The students will understand industrial processes, including the use of tools, methods of measurement, quality assurance, and the systems used to manufacture products in today's society. They may demonstrate content proficiency by:

- 3.1 Explaining quality control in manufacturing
- 3.2 Explaining the major manufacturing processes

- 3.3 Identifying and demonstrate use of common hand tools and fasteners
- 3.4 Being able to estimate and measure the size of objects in both SI and U.S. units
- 3.5 Measuring with precision measurement tools and instruments

**Standard 4: Materials**

Students will understand material classifications, characteristics, and testing in order to select appropriate materials for engineering products. They may demonstrate content proficiency by:

- 4.1 Identifying common materials
- 4.2 Comparing and contrast the physical properties of specific materials
- 4.3 Testing materials for specific characteristics
- 4.4 Selecting an appropriate material based on its characteristics to perform a specific function

**Standard 5: Communication and Teamwork**

Students will understand and demonstrate communication skills necessary in the field of engineering and will employ an individual and team approach while solving engineering problems. They may demonstrate content proficiency by:

- 5.1 Determining what known information is relevant
- 5.2 Reading and understanding design documentation and technical reports
- 5.3 Writing technical reports
- 5.4 Making an oral presentation
- 5.5 Expressing data in tables, graphs, charts and other visual formats
- 5.6 Contributing to the successful completion of a team project

**Standard 6: Engineering Systems**

Students will understand the relationships between force, work, rate, power, energy, resistance, and force transformers and demonstrate these principles on the engineering systems; mechanical, electrical, fluid, and thermal. They may demonstrate content proficiency by:

- 6.1 Solving problems using the concept of vectoring and predict the resultant forces
- 6.2 Identifying the six simple machines and their applications
- 6.3 Demonstrating the effect of resistance
- 6.4 Solving problems using appropriate units in engineering systems
- 6.5 Applying Ohm=s and Watt=s Laws Giving a physical description of inductors and capacitors and describe how they function
- 6.7 Using appropriate electrical units to solve problems
- 6.8 Identifying series, parallel, and combination circuits
- 6.9 Drawing a circuit diagram and lay out the circuit
- 6.10 Identifying the difference between analog and digital signals
- 6.11 Describing the function of a safety device
- 6.12 Giving examples of common AC and DC systems

- 6.13 Identifying what causes resistance in a fluid system
- 6.14 Giving examples of hydraulic and pneumatic systems
- 6.15 Identifying the three ways heat is transferred
- 6.16 Identifying the direction of heat flow given differences in temperature
- 6.17 Identifying appropriate use of insulation to minimize heat flow
- 6.18 Explaining the difference between Celsius and Fahrenheit scales
- 6.19 Describing heat conductors and insulators
- 6.20 Solving thermal problems using appropriate units

# Graphic Communications Technology Core

The Graphic Communications Technology Career Major prepares an individual for employment or advanced training in a variety of electronic, photographic, and printed communications media. This major prepares individuals to enter the workforce as technicians, technical report writers, and supervision managers.

The Career Major sequence of courses is tailored to each student's goal by providing the student the opportunity to enroll in such specialty courses as printing technology, advertising design, commercial photography, and multimedia. The Graphic Communications Technology Core Standards which follow are basic and integral to all courses in the Career Major.

## **Standard 1: Introduction to the Graphic Communications Industry**

Students will understand the historical, social, and economic impact of the graphic communications industry in society. They will demonstrate content proficiency by:

- 1.1 Describing the historical development of the graphic communications industry
- 1.2 Explaining the social impact of the graphic communications industry
- 1.3 Identifying the economics scope of the graphic communications industry (size, market segment, allied industries, and so forth)
- 1.4 Describing the various career opportunities and educational requirements for employment in the graphic communications industry
- 1.5 Identifying local educational institutions and programs that prepare students for employment in the graphic communications industry

## **Standard 2: Graphic Design**

Students will understand how basic design principles, typography, and illustration are used to persuade, communicate, identify, attract attention, or create action in a Layout. They will demonstrate content proficiency by:

- 2.1 Employing the proper sequence of events in the design process (target audience, product, budget, and so forth)
- 2.2 Preparing a layout using the proper sequence of events in the process (thumbnail, rough layout, comprehensive, and so forth)
- 2.3 Identifying type classifications (serif, san-serif, script, and so forth and basic typographical rules (readability, legibility, and so forth)
- 2.4 Demonstrating basic design principles (balance, proportion, contrast, and so forth)
- 2.5 Describing the different kinds of illustrations (pencil, ink, airbrush, and so forth)
- 2.6 Generating camera-ready artwork using a variety of methods (clip art, line art, half tones, and so forth)
- 2.7 Illustrating the advantages and disadvantages of black and white and color layouts as applied to graphic design
- 2.8 Explaining the classes of software including their capability, advantages, and disadvantages
- 2.9 Designing an advertisement that communicates an idea, service, or product effectively
- 2.10 Explaining the importance of, and use, teamwork in producing a product

**Standard 3: Electronic Imaging**

Students will understand the software, hardware, materials and tools used in a computerized desktop environment. They will demonstrate content proficiency by:

- 3.1 Identifying various items that can be designed and produced in a desktop environment
- 3.2 Identifying, distinguishing between, selecting, and using appropriate software for word-processing, graphics, scanning, and page layout processes
- 3.3 Organizing and demonstrating file management operations for opening, copying, saving, and deleting files
- 3.4 Identifying, selecting, and using appropriate hardware components used in the industry
- 3.5 Measuring copy in points and picas using appropriate tool
- 3.6 Defining letter, word, and line spacing as applied to typography
- 3.7 Demonstrating the alignment of text, element positioning, and rules of page design
- 3.8 Applying digital photography and electronic imaging
- 3.9 Creating a single color layout by placing copy and graphics from various applications into a page layout program
- 3.10 Describing postscript software capabilities
- 3.11 Explaining the various output media including image setters, digital presses, CD ROMs, and the Internet
- 3.12 Using correct terminology in identifying tools and materials used in a computerized desktop environment
- 3.13 Identifying various career opportunities and educational requirement in this sector of the graphic communications industry
- 3.14 Naming the educational institutions and programs that prepare students for employment in this sector of the graphic communications industry

**Standard 4: Manufacturing**

Students will understand the various processes used to produce graphic Communications products including print media (pre-press and press operations) and new media (digital imaging, video, animation, and so forth) they will demonstrate content proficiency by:

- 4.1 Identifying manufacturing processes and products produced from each process
- 4.2 Describing the advantages and disadvantages of various manufacturing processes
- 4.3 Identifying specific equipment and systems used in the visual communications/graphic arts manufacturing processes
- 4.5 Describing the production flow of a given product
- 4.6 Estimating the cost of materials and labor to produce a given product in house and outside
- 4.7 Identifying the material substrates and chemicals used in various manufacturing processes
- 4.8 Producing a product using one or more of the manufacturing processes
- 4.9 Using correct terminology in identifying tools and materials used in manufacturing processes
- 4.10 Identifying various career opportunities and educational requirement in this sector of the graphic communications industry
- 4.11 Naming the educational institutions and programs that prepare students for employment in this sector of the graphic communications industry

**Standard 5: Finishing and Distribution**

Students will understand the operations that comprise the final stages in the graphic communication reproduction process. They will demonstrate content proficiency by:

- 5.1 Identifying the major finishing processes and distribution operations in the graphic communication reproduction process
- 5.2 Identifying and using equipment and tools in the graphic communications finishing process
- 5.3 Identifying materials and supplies used in the graphic communications finishing process
- 5.4 Describing the advantages and disadvantages of various finishing and distributions operations. (Cost, equipment availability, media requirements, and so forth)
- 5.5 Demonstrating appropriate finishing operations for a specific product
- 5.6 Using correct terminology in identifying tools and materials used in the graphic communications finishing process
- 5.7 Identifying various career opportunities and educational requirement in this sector of the graphic communications industry
- 5.8 Naming the educational institutions and programs that prepare students for employment in this sector of the graphic communications industry

**Standard 6: Health and Safety in the Graphic Communications Industry**

Students will understand the importance of personal and worksite safety in the Graphics Communications industry and know how to maintain a safe working Environment for themselves and others. They will demonstrate content proficiency by:

- 6.1 Explaining the importance of occupational and personal safety
- 6.2 Identifying safe and unsafe working conditions in a work environment
- 6.3 Evaluating the safety conditions in a work facility
- 6.4 Exhibiting a positive attitude toward occupational and personal safety
- 6.5 Displaying safe working habits in the work environment
- 6.6 Using tools, materials, and equipment safely
- 6.7 Describing how and why toxic materials are health hazards
- 6.8 Handling toxic materials in a safe and environmentally responsible manner
- 6.9 Selecting and using appropriate safety equipment
- 6.10 Wearing appropriate protective clothing
- 6.11 Using appropriate protection for eyes and ears
- 6.12 Identifying and eliminating fire and toxic waste hazards
- 6.13 Identifying and eliminating physical hazards in a graphics facility

**Standard 7: Career Preparation**

Student will understand career preparation and work ethics and how they apply across all standards for students planing to successfully enter an advance in the graphic communication industry. They will demonstrate content proficiency by:

- 7.1 Exhibiting a positive attitude, self-confidence, honesty, integrity, self-discipline, and personal hygiene
- 7.2 Managing times and balance priorities to succeed in a work environment
- 7.3 Demonstrating capacity for life long learning
- 7.4 Working cooperatively with others, share responsibilities, except supervision and assume leadership roles
- 7.5 Identifying, locating and organizing needed information or data

- 7.6 Listening attentively and following instructions, requesting clarification or additional information as needed
- 7.7 Demonstrating proper ethics in the work place
- 7.8 Identifying legal regulations as they apply to the graphic communications industry (Sexual harassment, copyright laws, postal restrictions, and so forth)
- 7.9 Exhibiting job acquisition skills (resume writing, locate job openings, complete employment application forms and so forth)
- 7.10 Employing the proper sequence of events in the layout process (thumbnail, rough layout, comprehensive, and so forth)
- 7.11 Creating a layout using the proper sequence of events in the process (target audience, product, budget, and so forth)

# Manufacturing Technology Core

The Manufacturing Technology Career Major prepares an individual for employment or advanced training in systems approaches to primary and secondary material processing. This major prepares individuals to work as technicians, engineers, and professionals performing research and design, manufacturing, maintenance and service functions.

The Career Major sequence of courses is tailored to each student's goal by providing the student the opportunity to enroll in such specialty courses as machine tooling, welding, fabrication, and synthetics. The Manufacturing Technology Core Standards, which follow, are basic and integral to all courses in the career major.

## **Standard 1: Manufacturing Methods**

The student will understand the advantages and disadvantages of various manufacturing methods. They will demonstrate content proficiency by:

- 1.1 Investigating and evaluate appropriate manufacturing methods
- 1.2 Establishing an effective sequence of operations for a given design problem
- 1.3 Using appropriate manufacturing processes to produce an actual product

## **Standard 2: Machinery and Equipment**

The student will understand the machinery and equipment used to manufacture a given product. They will demonstrate content proficiency by:

- 2.1 Demonstrating the application of computerized controllers to operate machinery, equipment and processes
- 2.2 Demonstrating the use and application of hydraulic, pneumatic, and mechanical controls in manufacturing processes
- 2.3 Defending/justifying their selection of manufacturing machine tools to produce their product

## **Standard 3: Measurement in Manufacturing**

The student will understand the concepts of precision, accuracy, and appropriate units of measurement and their application in manufacturing processes. They will demonstrate content proficiency by:

- 3.1 Demonstrating their ability to select and utilize the proper measurement tool based on the product and required tolerance
- 3.2 Verifying proper calibration and take appropriate action to correct the measuring tools
- 3.3 Performing unit conversions between systems such as metric and traditional English based measurements

## **Standard 4: Environment and Manufacturing**

Students will understand the impact and importance of environmental issues related to manufacturing processes and organizations. They will demonstrate content proficiency by:

- 4.1 Describing roles and responsibilities of state and federal regulatory agencies that affect manufacturing operations
- 4.2 Studying and reporting on waste stream management of selected segments of manufacturing operations
- 4.3 Designing a plan to implement a basic recovery, disposal, recycling, or minimization system for industrial cleaning processes

**Standard 5: Material Processes**

The student will understand the different types of material processes. They will demonstrate content proficiency by

- 5.1 Evaluating and contrasting advantages of various mechanical processes
- 5.2 Evaluating and contrasting advantages of various chemical processes
- 5.3 Evaluating and contrasting advantages of various electrical processes
- 5.4 Evaluating and contrasting advantages of various thermal processes

**Standard 6: Material Selection**

Students will understand the uses and the requirements that material selection places on the manufacturing method and processes. They will demonstrate content proficiency by:

- 6.1 Demonstrating the ability to select an appropriate process for a given material
- 6.2 Selecting an appropriate material based upon product requirements
- 6.3 Evaluating the cost effectiveness of the material selections for a given product

**Standard 7: Manufacturing Costs**

Students will understand the actual cost in time, material, and tooling expenses related to the product manufacturing cycle. They will demonstrate content proficiency by:

- 7.1 Balancing quality requirements verses timely product completion in the manufacturing process
- 7.2 Determining the appropriate processes or methods to meet cost expectations
- 7.3 Understanding the relationship between the cost and material selection

**Standard 8: Planning, Scheduling, and Time Management**

Students will understand planning, scheduling, and time management for project completion. They will demonstrate content proficiency by:

- 8.1 Creating a planning sequence for the production of a product
- 8.2 Developing a schedule from start to completion of the product
- 8.3 Demonstrating their ability to modify or adapt their schedule and plan as required

**Standard 9: Communications**

The students will understand the standard communication (Electronic Industries Association, EIA) protocols for conveying electronic information in an industrial environment. They will demonstrate content proficiency by:

- 9.1 Demonstrating the ability to read and interpret technical drawings accurately
- 9.2 Demonstrating the ability to interface technical information between computers, machine controllers and machinery
- 9.3 Demonstrating the ability to convey information electronically

**Standard 10: Manufacturing Management**

The student will understand the different aspects of manufacturing management that includes Personal time management, Team participation/dynamics and scheduling of priorities. They will demonstrate content proficiency by:

- 10.1 Actively participating in or on a team
- 10.2 Developing a schedule for project completion
- 10.3 Balancing multiple demands for time (i.e., several products/processes/classes)

# Transportation & Energy Technology Core

The Transportation and Energy Technology Career Major prepares an individual for employment or advanced training in a variety of related industries. This major prepares individuals to work as technicians, managers, engineers, teachers, and professionals performing research and design, manufacturing, maintenance and service functions.

The Career Major sequence of courses is tailored to each student's goal by providing the student the opportunity to enroll in such specialty courses as automotive service excellence (ASE) automotive, ASE auto-body repair, ASE truck and diesel, and Federal Aviation Administration (FAR) Aircraft Carpentry. The Transportation and Energy Technology Core Standards which follow are basic and integral to all courses in the Career Major.

## **Standard 1: Safety Practices**

Students will understand the health and environmental hazards, safety practices, and personal attitude necessary to work safely in a shop. They will demonstrate content proficiency by:

- 1.1 Locating and reading *Right To Know* brochures, *M.S.D.S. Binder*, & *Hazardous Material Inventory Charts*
- 1.2 Passing a written safety test with a satisfactory score and correcting each question to the satisfaction of the instructor
- 1.3 Identifying, handling, storing, and disposal of hazardous materials per industry regulations
- 1.4 Identify work hazards typical of an automotive or truck repair shop and practicing work habits and ethics that ensure worker safety
- 1.5 Maintaining personal, tool, stall, and shop cleanliness standards while working
- 1.6 Wearing eye protection, hearing protection when necessary, and appropriate shop clothing while working
- 1.7 Practicing fire safety, including: location & operation of fire extinguishers, storage of flammable materials, awareness of ignition sources, emergency procedures, and first aid
- 1.8 Identifying location and contents of first aid kit and eye wash station
- 1.9 Demonstrating safe use of floor jacks, safety stands, hydraulic lifts, battery chargers, tire changer, wheel balancer, pneumatic impact tools, lubrication equipment, parts washers, Inspecting electrical power tools and equipment for hazards before using them

## **Standard 2: Shop Practices**

Students will understand the application of specific tools & shop equipment, using technical information systems, writing repair orders, work ethics, and service and repair procedures. They will demonstrate content proficiency by:

- 2.1 Following technical directions, diagnostic procedures, and text and reference explanations
- 2.2 Using appropriate measuring tools to measure dimensions to a tolerance of 1/64 inch and .001 inch or 0.001 mm
- 2.3 Correctly identify fractional and metric fasteners typical of the automotive and truck industry, including size, thread pitch, strength, and special application categories
- 2.4 Using a tap and a die to chase threads
- 2.5 Accurately torquing fasteners to factory specifications
- 2.6 Converting metric and fractional dimensions

- 2.7 Retrieving technical procedures, data, and specifications from printed and computerized sources
- 2.8 Utilizing Emissions and Certification Labels, Vehicle Identification Numberplates to accurately identify specific models, production year, engine type, etc.
- 2.9 Identifying basic hand tools and lab equipment
- 2.10 Selecting wrenches and sockets setups of the correct size and application
- 2.11 Selecting the correct screwdriver or internal drive for a given application
- 2.12 Selecting the correct punch or chisel for a given application
- 2.13 Lifting and safely supporting vehicles with floor jacks and safety stands
- 2.14 Identifying vehicle lift points and raising vehicles on a variety of hydraulic lifts
- 2.15 Disassembling, cleaning, and preparing gasket surfaces for gasket replacement
- 2.16 Delivering customer vehicle at industry standards, utilizing seat covers, floor mat protectors, fender covers, checking for interior, exterior, and under-hood cleanliness before finalizing the service

**Standard 3: Measurement**

Students will understand the measurement systems and scales used in the transportation and energy field. They will be able to demonstrate content proficiency by:

- 3.1 Measuring to 1/64" using a ruler or measuring tape
- 3.2 Measuring a gap using a feeler gauge
- 3.3 Measuring with a standard vernier or dial caliper
- 3.4 Measuring with a standard micrometer
- 3.5 Converting between metric and standard U.S. measuring systems
- 3.6 Calculating engine displacement when given bore, stroke, and number of cylinders
- 3.7 Using a standard torque wrench to tighten a bolt

**Standard 4: Application of Scientific Principles**

Students will understand scientific principles, both physical and chemical, in relation to automotive systems. They will demonstrate content proficiency by:

- 4.1 Identifying different lubricants and performing automotive lubrication service
- 4.2 Describing basic electrical system operation and performing test procedures
- 4.3 Describing ignition system operation and performing preventative maintenance
- 4.4 Describing fuel system requirements and performing preventative maintenance
- 4.5 Describing cooling system operation and performing test procedures and maintenance

**Standard 5: Environmental and Emissions Principles**

Students will understand the cause and effect of transportation emissions on the environment. Primary emphasis will be placed on truck and automotive emissions and regulations governing the industry. The students will understand the basics of the OSHA Hazardous Waste Training program. They will demonstrate content proficiency by:

- 5.1 Discussing the history of the state and federal emissions programs
- 5.2 Identifying the regulatory bodies that govern the industry
- 5.3 Explaining the composition of photo-chemical smog
- 5.4 Demonstrating the use of the five gases analyzer in emissions testing
- 5.5 Performing basic emission system function tests on the following: Crankcase ventilation, Evaporative controls, Air injection, exhaust gas re-circulation, catalytic converters, thermostatic air systems, sensors and actuators, handle hazardous waste appropriately

- 5.6 Demonstrating the use of hazardous product labels and safety data sheets
- 5.7 Identifying external combustion emission sources

**Standard 6: Application of Mechanical Principles**

Students will understand mechanical principles in relation to automotive power train and chassis systems. They will demonstrate content proficiency by:

- 6.1 Identifying automotive fasteners and applying their proper use
- 6.2 Identifying engine components and describing the four stroke cycle
- 6.3 Identifying drive train components and describing their operation
- 6.4 Identifying brake system components and inspecting their condition
- 6.5 Identifying suspension system components and describing alignment angles

**Standard 7: Internal Combustion Engines**

Students will understand the operating principles of internal combustion engines in Automotive and truck applications. They will test and analyze an internal combustion engine in a lab situation. They will demonstrate content proficiency by:

- 7.1 Explaining the valve and piston position for each of the four strokes in the four stroke cycle engine
- 7.2 Identifying basic engine parts
- 7.3 Explaining valve timing in relation to crankshaft position
- 7.4 Performing lubrication system service
- 7.5 Performing a compression test (wet and dry)
- 7.6 Performing a cylinder leak-down test
- 7.7 Performing a spark test
- 7.8 Performing a fuel supply test
- 7.9 Performing a fuel injector signal test
- 7.10 Performing a oil pressure test
- 7.11 Performing a timing check
- 7.12 Performing a spark advance test
- 7.13 Performing a air restriction test

**Standard 8: Automotive Brake and Hydraulic Systems**

Students will understand the basic principles of hydraulic systems as used in the transportation and energy field. They will demonstrate content proficiency by performing the following tasks:

- 8.1 Describe how hydraulic systems transfers foot-pressure into braking power
- 8.2 Calculate the amount of force or pressure in a closed hydraulic system by using the equation: Pressure equals Force divided by Area ( $P=F/A$ )
- 8.3 Identify brake system components
- 8.4 Manually bleed a hydraulic brake system
- 8.5 Remove a brake drum
- 8.6 Inspect a drum and disc brake system
- 8.7 Remove and replace standard brake shoes
- 8.8 Perform a brake adjustment on drum brakes
- 8.9 Repack and adjust tapered roller wheel bearings
- 8.10 Replace a wheel-bearing cup
- 8.11 Adjust a parking brake

**Standard 9: Automotive Electrical and Electronics**

Students will understand the qualities of electricity and be able to measure them on modern automobiles and trucks using digital meters. Students will be able to read wiring diagrams and use electrical test equipment to diagnose, test, and repair common electrical and electronic faults. They will demonstrate content proficiency by:

- 9.1 Defining electricity
- 9.2 Explaining Ohm's Law
- 9.3 Identifying electrical circuits and devices
- 9.4 Demonstrating the use of auto information systems
- 9.5 Understanding wiring diagrams
- 9.6 Being knowledgeable of basic electronics
- 9.7 Demonstrating the use of a test light and a DVOM
- 9.8 Solving two electrical problems in each of the following areas: Battery, Starting System, Charging System, Ignition Systems, Computerized Engine Control System, Lighting, and Accessories.

**Standard 10: Routine Maintenance and Service Procedures**

Students will understand the need for preventative maintenance on a vehicle. Students will be able to locate and interpret necessary reference information and perform tasks required for proper vehicle maintenance, including recommended periodic services as specified by the vehicle manufacturer. They will demonstrate content proficiency by performing the following tasks:

- 10.1 Check engine oil level
- 10.2 Change engine oil
- 10.3 Change engine oil filter
- 10.4 Check brake master cylinder fluid level
- 10.5 Check clutch master cylinder fluid level
- 10.6 Check power steering fluid level
- 10.7 Check coolant level
- 10.8 Inspect hoses
- 10.9 Identifying cooling system parts
- 10.10 Visually perform cooling system inspection
- 10.11 Check coolant freeze protection
- 10.12 Drain, refill, and bleed cooling system
- 10.13 Inspect vacuum hose condition
- 10.14 Perform glass and ceramic fuse testing and service
- 10.15 Replace a tail/brake light bulb
- 10.16 Replace a turn signal flasher
- 10.17 Replace a sealed beam headlamp
- 10.18 Replace a composite headlamp bulb
- 10.19 Service a battery (terminals/electrolyte level)
- 10.20 Perform a tire inspection
- 10.21 Identify tire labeling
- 10.22 Identify causes of tire wear
- 10.23 Adjust tire pressure
- 10.24 Inspect accessory drive belts
- 10.25 Visually inspect battery
- 10.26 Inspect operation of the vehicle lighting system
- 10.27 Service a windshield wiper blade
- 10.28 Inspect windshield wiper reservoir level

- 10.29 Check automotive transmission fluid level
- 10.30 Inspect exhaust system
- 10.31 Inspect suspension and steering linkage
- 10.32 Inspect gear case fluid levels
- 10.33 Perform a complete lubrication, maintenance & inspection (LOF)
- 10.34 Replace a radiator hose
- 10.35 Replace a heater hose
- 10.36 Adjust alternator V-belt tension
- 10.37 Adjust alternator V-ribbed belt tension
- 10.38 Replace a V-belt
- 10.39 Replace a V-ribbed belt
- 10.40 Replace a serpentine belt
- 10.41 Identify and locate basic engine parts
- 10.42 Identify ignition system components
- 10.43 Determine firing order and explain its significance
- 10.44 Identify cylinder arrangement and cylinder head classification (OHC/pushrod, etc.)
- 10.45 Service ignition and fuel system components according to industry standards
- 10.46 Remove, gap, and install spark plugs
- 10.47 Replace fuel filter
- 10.48 Check and adjust ignition base timing to manufacturer specification
- 10.49 Check computer controlled-ignition base timing

**Standard 11: Reference Materials and Research Procedures**

Students will understand and be proficient in the utilization of various forms of reference materials common to the Transportation and Energy Technology industries as they relate to course content and entry-level skills. Students will be able to locate, interpret, and communicate data required for the efficient and accurate execution of repair and service procedures. They will demonstrate content proficiency by performing the following tasks:

- 11.1 Properly complete a Repair Order based on a service interview with a customer or customer's representative
- 11.2 Locate, interpret, and communicate information relative to the handling and disposal of hazardous materials
- 11.3 Locate, interpret, and communicate information found in the Vehicle Identification Number (VIN)
- 11.4 Locate, interpret, and communicate information found on the Under Hood Label
- 11.5 Locate, interpret, and communicate information found in Service Manuals
- 11.6 Locate, interpret, and communicate Maintenance Specifications
- 11.7 Operate a computerized technical information retrieval system
- 11.8 Locate, interpret, and communicate information found in a labor time-guide (Flat-Rate Manual)
- 11.9 Locate, interpret, and communicate information on the required emission control system components and identifying those components correctly on a vehicle

**Standard 12: Fault Analysis and Resolution**

Students will understand the steps that lead to fault diagnosis. They will analyze the cause of a system failure in accordance with accepted trade practices by:

- 12.1 Inspecting systems and components
- 12.2 Measuring using appropriate equipment for the system or component
- 12.3 Comparing manufacturer specifications to their findings on component

- 12.4 Using a diagnostic tree to locate a fault
- 12.5 Suggesting necessary action for resolution of the fault
- 12.6 Adjusting, repairing or replacing components as necessary to resolve the fault

**Standard 13: Business Practices**

Students will understand the business practices of a shop. They will generate and maintain business forms in a manner consistent with current industry practice by:

- 13.1 Filling out legally required information on a Repair Order
- 13.2 Writing a customers complaint
- 13.3 Verifying the complaint
- 13.4 Describing the findings on inspection
- 13.5 Documenting the tests performed to determine the needed repair
- 13.6 Listing the repair procedure followed
- 13.7 Documenting the correction of the problem as a result of the repair. (Quality Assurance)

**Standard 14: Transportation Systems**

Students will understand the function and design of transportation systems used for commercial and recreational activities. They will demonstrate their knowledge of land, water, aerospace and alternative forms of transportation systems by:

- 14.1 Describing the basic operational components of these systems
- 14.2 Classifying transportation systems by how they are most effectively used as related to their operational environment
- 14.3 Describing the design and function of propulsion power systems used for various types of transport vehicles
- 14.4 Classifying transportation systems as related to payload requirements and design
- 14.5 Describing the functional operation of each transportation system as related to scientific principles, theory and practice

**Standard 15: Automotive Electrical Power and Energy**

Students will have a basic understanding of electricity and how it is generated. Students will be able to explain how electricity is put to work in modern automobiles and trucks. They will demonstrate content proficiency by:

- 15.1 Demonstrating knowledge of subatomic theory
- 15.2 Defining electricity
- 15.3 Stating the sources of electricity
- 15.4 Understanding three types of energy conversions
- 15.5 Giving examples of how modern automobiles and trucks use electrical power

**Standard 16: Outdoor Power Equipment**

Students will understand the design and use of outdoor power equipment. They will demonstrate their knowledge and content proficiency by:

- 16.1 Describing the basic operational types of equipment as related to the specific work function and product design
- 16.2 Describing the operation and design of the power producing unit which drives the work producing mechanism on each type of equipment
- 16.3 Classifying outdoor power equipment as related to payload, work function and environmental requirements for which each piece of equipment is designed

- 16.4 Describing the interface between industry and the Aend-user@ in the creation and design of equipment for specific application in the field
- 16.5 Performing maintenance and repair procedures that meet industry prescribed standards for outdoor power equipment

**Standard 17: Leadership Management**

Students will understand leadership and management as related to vocational education and workplace interaction. They will demonstrate their ability and proficiency in leadership and management by:

- 17.1 Participating in student organizations which promote leadership and management
- 17.2 Adopting and following professional standards of conduct and job performance
- 17.3 Promoting organizational efforts related to professional trade associations
- 17.4 Becoming active in professional and/or student trade organizations at the local, state and national level

# RESOURCES

## WEBSITES:

The following web sites are a cross section of those available, which contain information regarding Industrial Technology Education Programs, Carl D. Perkins and School-to-Career program and funding information. Specific information may be obtained by connecting to links established on each site. It is suggested that you bookmark the most used sites or links you visit frequently.

### CALIFORNIA

California Department of Education .....	<a href="http://www.cde.ca.gov">http://www.cde.ca.gov</a>
Academic and Career Integration Unit .....	<a href="http://www.cde.ca.gov/acj">http://www.cde.ca.gov/acj</a>
California Community College Chancellor's Office.....	<a href="http://www.cccco.edu">http://www.cccco.edu</a>
Perkins State plan.....	<a href="http://www.vteastateplan.com">http://www.vteastateplan.com</a>
School-to-Career .....	<a href="http://www.stc.ca.gov">www.stc.ca.gov</a>
School-to-Career Clearinghouse.....	<a href="http://www.stc-clearinghouse.com">http://www.stc-clearinghouse.com</a>
Assessment in Career Education (ACE).....	<a href="http://www.cde.ca.gov/statetests/ace/ace.html/">http://www.cde.ca.gov/statetests/ace/ace.html/</a>
West Ed (C-TAP Materials).....	<a href="http://www.wested.org">http://www.wested.org</a>
California SkillsUSA-VICA.....	<a href="http://casusa.org">http://casusa.org</a>

### NATIONAL

U.S. Dept. of Education (office of Voc. Ed.).....	<a href="http://www.ed.gov/offices/OVAE/vocsite.html">http://www.ed.gov/offices/OVAE/vocsite.html</a>
National School to Work.....	<a href="http://www.stw.ed.gov">http://www.stw.ed.gov</a>
SkillsUSA-VICA.....	<a href="http://www.skillusa.org">http://www.skillusa.org</a>
National Skill Standards Board.....	<a href="http://www.nssb">http://www.nssb</a>

## **Selected Publications**

High School Teaching and Learning Office. (1996). Industrial and Technology Education: Career Path Guide and Model Curriculum Standards. Sacramento, CA: California Department of Education.

Copies of this publication are available from:

Bureau of Publications, Sales Unit  
California Department of Education  
P.O. Box 271, Sacramento, CA 95812-0271  
FAX (916) 323-0823

Technology for All Americans. (2000). Standards for Technological Literacy: Content for the study of technology (Technology Content Standards). Reston, VA: International Technology Education Association.

Technology for all Americans. (1996). Technology for all Americans: A rationale and structure for the study of technology (Rational and structure). Reston, VA: International Technology Education Association

Copies of these publications are available from:

International Technology Education Association  
1914 Association Drive, Suite 201  
Reston, VA 20191-1539  
Phone: (703) 860-2100  
FAX (703) 860-0353