



California Subject Examinations for Teachers®

TEST GUIDE

INDUSTRIAL AND TECHNOLOGY EDUCATION SUBTEST II

Subtest Description

This document contains the Industrial and Technology Education subject matter requirements arranged according to the domains covered by Subtest II of CSET: Industrial and Technology Education. In parentheses after each named domain is the domain code from the Industrial and Technology Education subject matter requirements.

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California Subject Examinations for Teachers (CSET®)

**Industrial and Technology Education
Subtest II: Power and Energy; Information and Communication;
Project and Product Development**

**Part I: Content Domains for Subject Matter Understanding and Skill in
Industrial and Technology Education**

POWER AND ENERGY (SMR Domain 2)

Candidates demonstrate an understanding of the fundamental scientific concepts of power and energy and how these concepts apply to mechanical, fluid, thermal, and electrical systems. Candidates understand the generation, transmission, storage, and control of power and energy and apply this knowledge to design, maintain, and analyze a variety of power and energy technologies, including transportation technologies.

0001 Processes (SMR 2.1)

- a. Demonstrate an understanding of power generation processes (e.g., geothermal, nuclear, solar, fossil fuel, fuel cell).
- b. Apply scientific principles of work, power, energy, and efficiency to analyze energy transformations.
- c. Demonstrate an understanding of processes for energy storage (e.g., dams, flywheels, batteries).
- d. Solve problems using mathematical concepts related to power and energy (e.g., Ohm's law, Pascal's law, moment of inertia, time, distance, velocity).
- e. Apply concepts of power and energy to analyze a variety of technological systems (e.g., mechanical, fluid, electrical, thermal).

0002 Systems (SMR 2.2)

- a. Understand safety principles, safety regulations, and safety engineering.
- b. Describe and analyze systems that convert energy from one form to another (e.g., engines, generators, actuators).
- c. Describe components and analyze characteristics of power control systems (e.g., brakes, valves, switches, circuit breakers).
- d. Understand power transmission systems (e.g., gears, cams, parallel and series circuits, pulleys, pumps).
- e. Demonstrate knowledge of the architecture and infrastructure associated with land, sea, aerospace, and intermodal transportation systems (e.g., rapid transit, shipping lanes, highways, locks, flight patterns).

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0003 Resources (SMR 2.3)

- a. Demonstrate an understanding of renewable (e.g., solar, wind, biomass) and nonrenewable (e.g., fossil, nuclear, chemical) energy sources.
- b. Demonstrate an understanding of the uses and properties of materials (e.g., fuels, lubricants, conductors).
- c. Demonstrate an understanding of a variety of power and energy tools and equipment (e.g., multimeter, torque wrench, dynamometer).

INFORMATION AND COMMUNICATION (SMR Domain 3)

Candidates demonstrate an understanding of the knowledge and skills needed to design, analyze, use, and maintain a variety of communication systems. They demonstrate an understanding of how information systems encode, transmit, receive, decode, and store data. Candidates understand principles of graphic communication and use appropriate graphic tools to communicate visually. They apply knowledge of circuits and their components to electronic communication systems.

0004 Design Processes (SMR 3.1)

- a. Demonstrate an understanding of design documentation (e.g., blueprints, mock-ups, storyboards, schematics).
- b. Apply practical design concepts (i.e., form and function) to solve problems in communication.
- c. Understand computer design (e.g., hardware, software).
- d. Demonstrate an understanding of drawing and drafting principles (e.g., lettering, multiview drawing, dimensioning).

0005 Systems (SMR 3.2)

- a. Apply knowledge of imaging and image production (e.g., photographic, electronic, print).
- b. Analyze characteristics of telecommunication systems.
- c. Analyze characteristics of broadcast communication systems.
- d. Understand processes (e.g., preproduction, production, distribution) for developing multimedia systems.

0006 Resources (SMR 3.3)

- a. Demonstrate an understanding of the materials (e.g., media, electronic components), tools (e.g., test equipment, software, hand tools), and equipment (e.g., hardware, imaging equipment) used in information and communication systems.

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- b. Understand strategies for the effective use of information resources (e.g., data banks, subject matter experts, search engines).
- c. Demonstrate an understanding of communication systems architecture and infrastructure (e.g., analog systems, digital systems, mainframes, client servers, network architecture).
- d. Understand criteria for the selection of appropriate materials, tools, and equipment used in information and communication systems.

0007 Security and Privacy (SMR 3.4)

- a. Understand physical security systems (e.g., locks, access control, motion detectors, surveillance, intrusion detection).
- b. Understand electronic security systems (e.g., access and permissions, passwords, user IDs, roles of administrators and end users, encryption).
- c. Demonstrate an understanding of principles related to security compliance procedures (e.g., personal responsibility, job function, need-to-know basis, ethical and legal).

PROJECT AND PRODUCT DEVELOPMENT (SMR Domain 4)

Candidates demonstrate an understanding of product development and how to plan, manage, and produce manufacturing and construction systems. Candidates understand the resources and processes needed to safely use a variety of processes to design, produce, maintain, and evaluate products. Candidates demonstrate an understanding of the requirements and constraints in the engineering design process and the systems approach to manufacturing and construction enterprises. Candidates understand issues associated with quality management and quality control, including statistical tools.

0008 Engineering Principles (SMR 4.1)

- a. Understand the project and product design process (e.g., needs assessment, product analysis, prototyping, production design, design for manufacturing).
- b. Understand safety principles, safety regulations, and safety engineering.
- c. Understand a variety of mathematical concepts and applications (e.g., measurement, tolerance, financial calculations) for product development.
- d. Understand principles of data collection, communication, and analysis (e.g., sampling, graphical representations, statistical measures).

0009 Manufacturing and Construction Processes (SMR 4.2)

- a. Understand processes involved in manufacturing (e.g., casting, forming, shaping, finishing, assembling, packaging).
- b. Understand project (e.g., building trades, multimedia, transportation) construction processes.

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- c. Understand manufacturing and construction codes, regulations, and industry guidelines (e.g., OSHA, zoning, building codes, Environmental Impact Reports).
- d. Understand the role of research and development in manufacturing and construction enterprises.
- e. Understand operations management (e.g., cost estimation, decision making, capacity planning).

0010 Resources (SMR 4.3)

- a. Demonstrate an understanding of the proper identification, selection, use, and maintenance of tools and equipment (e.g., hand tools, power tools, measurement instruments).
- b. Demonstrate an understanding of the identification, selection, and use of materials (e.g., wood, metals, plastics, composites, polymers).
- c. Demonstrate an understanding of the supply chain and its components (e.g., vendors, just-in-time).

0011 Quality Assurance (SMR 4.4)

- a. Understand principles and procedures of product testing (e.g., source, in-process, final inspection).
- b. Demonstrate an understanding of strategies for obtaining and responding to customer feedback.
- c. Demonstrate knowledge of the development and purpose of industry standards such as Institute of Electrical and Electronics Engineers (IEEE), International Organization for Standardization (ISO), and American National Standards Institute (ANSI).
- d. Understand the principles of total quality management (TQM).
- e. Identify principles and strategies of change management (e.g., software version numbers, building codes, change orders).

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**Part II: Subject Matter Skills and Abilities
Applicable to the Content Domains in Industrial and Technology Education**

Candidates demonstrate an understanding of the nature of technology and of the core technological concepts that remain constant as technological progress accelerates. Candidates understand the design process as a problem-solving model and are able to use it to solve problems in industrial and technology education. They apply core academic knowledge of industrial and technology education, including science, mathematics, measurement, economics, and data analysis to investigate and design technological systems and processes. Candidates are able to effectively communicate designed solutions using a variety of technologies and propose strategies for implementing the solutions. They understand how to use the tools, machines, resources, and processes needed to turn ideas into workable solutions. In addition, candidates understand and apply safety rules and practices in the classroom, laboratory, and workplace.

Candidates have knowledge of historical events, current research, and recent developments in technology and industry. Candidates have knowledge of interactions between technology and society (cultural, social, economic, and environmental) in which technologies are used. They demonstrate an understanding of the importance of continued education (e.g., professional organizations, technical publications, industry, research and development) for staying current with technological innovations. They are able to work with industry representatives and community organizations to identify industry trends and job opportunities, employers' expectations, and the personal characteristics (e.g., appropriate work habits, social and communication skills) necessary for obtaining and maintaining employment in industry and technology. They demonstrate an understanding of career planning and development and student leadership opportunities, along with the skills and attitudes needed for developing successful careers in industry and technology. Candidates are aware of the characteristics, functions, and structures of student leadership organizations, clubs, and competitive groups (e.g., SkillsUSA®, Technology Student Association [TSA]) and the candidates' roles and responsibilities as advisors.