Texas CTE

# Science, Technology, Engineering, and Mathematics (2010): Grade 9

Adopted 2010

**Concepts of Engineering and Technology**

**(1) The student investigates the components of engineering and technology systems. The student is expected to:**

- (A) investigate and report on the history of engineering science;
- (B) identify the inputs, processes, and outputs associated with technological systems;
- (C) describe the difference between open and closed systems;
- (D) describe how technological systems interact to achieve common goals;
- (E) compare and contrast engineering, science, and technology careers; and
- (F) conduct and present research on emerging and innovative technology.

**(2) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:**

- (A) use clear and concise written, verbal, and visual communication techniques;
- (B) maintain a design and computation engineering notebook;
- (C) use sketching and computer-aided drafting and design to present ideas; and
- (D) maintain a portfolio.

**(3) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:**

- (A) master relevant safety tests;
- (B) follow safety guidelines as described in various manuals, instructions, and regulations;
- (C) recognize the classification of hazardous materials and wastes;
- (D) dispose of hazardous materials and wastes appropriately;
- (E) perform maintenance and safely handle and store laboratory equipment;
- (F) describe the implications of negligent or improper maintenance; and
- (G) demonstrate the use of precision measuring instruments.

**(4) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:**

- (A) describe how technology has affected individuals, societies, cultures, economies, and environments;
- (B) describe how the development and use of technology influenced past events;
- (C) describe how and why technology progresses; and
- (D) predict possible changes caused by the advances of technology.

**(5) The student describes the importance of teamwork, leadership, integrity, honesty, ethics, work habits, and organizational skills. The student is expected to:**

- (A) describe and demonstrate how teams function;
- (B) identify characteristics of good team leaders and team members;
- (C) work in a team face-to-face or in a virtual environment to solve problems;
- (D) discuss the principles of ideation;
- (E) identify employers' expectations and appropriate work habits;
- (F) differentiate between discrimination, harassment, and equality;
- (G) describe ethical behavior and decision making through use of examples;
- (H) use time-management techniques to develop team schedules to meet project objectives; and
- (I) complete projects according to established criteria.

**(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:**

- (A) identify and describe the fundamental processes needed for a project, including design and prototype development;
- (B) identify the chemical, mechanical, and physical properties of engineering materials;
- (C) use problem-solving techniques to develop technological solutions;
- (D) use consistent units for all measurements and computations; and
- (E) assess risks and benefits of a design solution.

**(7) The student understands the opportunities and careers in fields related to biotechnology. The student is expected to:**

(A) describe the fields of biotechnology;

(B) describe career opportunities in biotechnology;

(C) apply design concepts to problems in biotechnology;

(D) identify fields related to biotechnology; and

(E) identify currently emerging issues in biotechnology.

**(8) The student understands the opportunities and careers in fields related to process control and automation systems. The student is expected to:**

(A) describe applications of process control and automation systems;

(B) describe career opportunities in process control and automation systems;

(C) apply design concepts to problems in process control and automation systems;

(D) identify fields related to process control and automation systems; and

(E) identify emerging issues in process control and automation systems.

**(9) The student understands the opportunities and careers in fields related to physical and mechanical systems. The student is expected to:**

(A) describe the applications of physical and mechanical systems;

(B) describe career opportunities in physical and mechanical systems;

(C) apply design concepts to problems in physical and mechanical systems; and

(D) identify emerging issues in physical and mechanical systems.

**(10) The student participates in a team-based culminating project. The student is expected to:**

(A) apply the design process in a team;

(B) assume different roles as a team member within the project;

(C) maintain an engineering notebook for the project;

(D) develop and test the model for the project; and

(E) present the project using clear and concise communication skills.

**Biotechnology**

**(1) The student explores biotechnology career opportunities. The student is expected to:**

(A) determine interests and aptitudes through conversations with biotechnology professionals;

(B) identify career options in the field of biotechnology;

(C) identify reliable sources of career information;

(D) research interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation;

(E) seek a mentor in the biotechnology area;

(F) identify conventional and non-conventional career opportunities that match interests and aptitudes;

(G) research applications of biotechnology and biomaterials in the areas of medicine, the environment, and pharmaceutical, agricultural, and industrial settings; and

(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines.

**(2) The student evaluates ethical and legal issues in biotechnology. The student is expected to:**

(A) identify current ethical and legal issues;

(B) describe the history of biotechnology and related current issues;

(C) discuss legal and technology issues for at least two biotechnology related areas; and

(D) compare and contrast examples of objective and subjective scientific, economic, and political data and positions used to defend biotechnology views.

**(3) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:**

(A) identify local, state, and federal agencies responsible for regulating the biotechnology industry;

(B) identify professional organizations participating in the development of biotechnology policies;

(C) identify and define terms related to biotechnology regulations; and

(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations, including those in the agricultural and health areas.

**(4) The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:**

(A) identify professional publications;

(B) identify the various biotechnology industry sectors; and

(C) investigate and report on career opportunities in the biotechnology industry sectors.

**(5) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:**

(A) demonstrate verbal, nonverbal, written, and electronic communication skills;

(B) demonstrate skills used to secure and maintain employment;

(C) demonstrate appropriate workplace etiquette; and

(D) display productive work habits and attitudes.

**(6) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:**

(A) investigate at least three end products from biotechnology manufacturing processes;

(B) investigate the effects of waste on environmental and biological life cycles;

(C) investigate the impacts of waste on the environment;

(D) analyze the results of manufacturing refuse;

(E) explain the negative impacts of waste with respect to the individual, society, and the global population;

(F) research solutions to biological waste with respect to commercial applications through investigation of various pollution waste treatments using natural organisms;

(G) investigate biotechnology as it relates to health and well-being; and

(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety.

**(7) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:**

(A) identify the ability to change or enhance genetic characteristics;

(B) identify applications of genetic engineering;

(C) identify applications of nanotechnology in biotechnology;

(D) identify applications of bioinformatics in biotechnology;

(E) identify the applications of biotechnology in medicine, forensics, and law enforcement; and

(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology.