

## DESCRIPTION

A foundational engineering design course that introduces basic problem-solving and documentation skills. Various aspects of engineering will be explored along with technology's environmental, societal, political, and economic impacts on our world. By utilizing problem-solving skills, students will develop essential abilities and attitudes that will in turn expand their occupational opportunities in the world of engineering.

Total Test Questions: 25

Levels: 9

Units of Credit: 0.5

Prerequisites: None

## STANDARDS, OBJECTIVES, AND INDICATORS

### STANDARD 1

8% of Exam Blueprint

#### STUDENTS WILL FOLLOW SAFETY PRACTICES.

- Objective 1: Identify potential safety hazards and follow general laboratory safety practices.
1. Assess workplace conditions with regard to safety and health.
  2. Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
  3. Locate and understand the use of shop safety equipment.
  4. Select appropriate personal protective equipment.
- Objective 2: Use safe work practices.
1. Use personal protective equipment according to manufacturer rules and regulations.
  2. Follow correct procedures when using any hand or power tools.
  3. Keep the workplace clean.
- Objective 3: Complete a basic safety test without errors (100%) before using any tools or shop equipment.

### STANDARD 2

27% of Exam Blueprint

#### STUDENTS WILL UNDERSTAND THE ELEMENTS OF AN ORGANIZED APPROACH TO SOLVING AN ENGINEERING DESIGN PROBLEM.

- Objective 1: Form a basic design process that can be used to solve an engineering problem.
1. Identify & define the design problem
  2. Brainstorm solutions
  3. Create models & build a prototype
  4. Test the prototype
  5. Redesign and optimize
- Objective 2: In order to recognize the elements of design, students should learn that:
1. Design problems are seldom presented in a clearly defined form.
  2. The design needs to be continually checked and critiqued, and the ideas of the design must be refined and improved.



3. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.
- Objective 3: In order to better comprehend the engineering design process, students should learn that:
1. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.
  2. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
  3. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
  4. The process of engineering design takes in to account a number of factors including safety, reliability, cost, quality control, the environment, manufacturability, maintenance and repair, and human factors.
- Objective 4: In order to use other problem-solving approaches, students should learn that:
1. Technological problems must be researched before they can be solved.
  2. Many technological problems require a multidisciplinary approach.
  3. Apply the “5 Whys” root-cause analysis approach to problem-solving.

## STANDARD 3

**22% of Exam Blueprint**

### STUDENTS WILL APPLY THE ELEMENTS OF AN ENGINEERING DESIGN PROCESS TO PRODUCE AND/OR DEVELOP A PRODUCT OR SYSTEM.

- Objective 1: Identify the design problem and decide how to address it.
1. Analyze market research to determine consumer wants and needs (requirements).
  2. Investigate existing design solutions.
  3. Identify requirements and constraints and determine how they will affect the design process and record them in an engineering notebook.
  4. Clearly and concisely define the problem to be solved and the measurements of successfully addressing the problem in an engineering notebook.
- Objective 2: As a team, brainstorm possible solutions.
1. Document multiple solutions in an engineering notebook.
  2. Evaluate the strengths and weaknesses of each proposed solution.
  3. Decide on and record the best solution in an engineering notebook.
- Objective 3: Using available facilities and materials, create a prototype of the proposed design.
1. Mathematical models
  2. 3D solid modeling
  3. 3D printed models
  4. Scale models
- Objective 4: Test the prototype, record the results, and evaluate the performance of the design.
1. Identify and record both failures and successes in an engineering notebook.
  2. Evaluate the performance of the prototype against the stated requirements.
- Objective 5: Redesign the prototype by repeating the design process in order to further optimize the design.
1. Reconsider any discarded ideas.
  2. Look for mathematical relationships and use them to identify the factors that affect the design the most.



3. Record the results of the engineering process in an engineering notebook.

## **STANDARD 4**

**27% of Exam Blueprint**

**◆ STUDENTS WILL DOCUMENT THE DESIGN PROCESS AND COMMUNICATE IT TO DIFFERENT AUDIENCES USING APPROPRIATE TECHNIQUES.**

- Objective 1: Make accurately proportioned sketches using correct drawing conventions
1. Notes are neat and legible
  2. Objects should be drawn to correct proportions
  3. Dimensions are used appropriately
  4. Views can be isometric, orthogonal, sections, or assemblies
- Objective 2: Create and utilize an engineering notebook per established conventions
1. Sequential and chronological
  2. Accurate and complete reflection of the progress being recorded
  3. Sketches or pictures are included where appropriate
  4. No loose entries or pages
  5. Each page is dated and witnessed
  6. Unused spaces are identified and lined out
  7. Errors are not erased or obliterated
  8. Test data and calculations are included
- Objective 3: Develop a presentation that provides an overview of each step of the student's design experience using a variety of media
1. Flow charts
  2. Time charts
  3. Spreadsheets
  4. Graphs

## **STANDARD 5**

**16% of Exam Blueprint**

**◆ STUDENTS WILL INVESTIGATE CAREER OPPORTUNITIES IN ENGINEERING.**

- Objective 1: Identify occupations related to engineering.
- Objective 2: List and differentiate among different engineering disciplines.
- Objective 3: Investigate different types of occupational training.
- Objective 4: Recognize and demonstrate 21st-Century or "soft" skills and attributes.
1. Attendance
  2. Reliability
  3. Effective communication
  4. Teamwork



## PERFORMANCE STANDARD EVALUATION CHECKLIST

Student Name \_\_\_\_\_

Instructor's Name \_\_\_\_\_

School \_\_\_\_\_ District \_\_\_\_\_

### Performance Rating Scale:



Limited Skills.....Moderate Skills.....High Skills

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated written exam. To pass the performance standard the student must attain a performance standard average of **8 or higher** on the rating scale. Students may be encouraged to repeat the objectives until they average **8 or higher** for the following elements:

PERFORMANCE SKILLS OBJECTIVES	
Standard 1 – Follows safety practices.	Score:
Standard 2 – Develops an understanding of the characteristics and scope of technology, the core concepts of technology, and the relationships among and between technologies and other fields of study.	Score:
Standard 3 – Develops an understanding of the cultural, social, economic, and political effects of technology, the effects of technology on the environment, the role of society in the development and use of technology, and the influence of technology on history.	Score:



# Engineering Technology (615)

Standard 4 – Participate in a problem-based learning activities that explore engineering and a range of other technological areas.	Score:
<b>PERFORMANCE SKILLS STANDARDS</b>	
Standard 5 – Students are aware of careers related to each selected area of technology.	Score:
<b>PERFORMANCE OBJECTIVE AVERAGE</b>	<b>Average:</b>

