

DESCRIPTION

The first in a sequence of “hands on” courses that tie observations and concepts common to a variety of different engineering disciplines in order to develop a better understanding of basic math and science principles used in engineering. By utilizing problem-solving skills in a laboratory environment, students will develop skills and attitudes that impact and expand occupational opportunities. This is a foundation course in the Engineering pathway.

Total Test Questions: 36

Levels: 10-12

Units of Credit: .50

Prerequisites: None

STANDARDS, OBJECTIVES, AND INDICATORS

STANDARD 1

8% of Exam Content

◆ STUDENTS WILL FOLLOW SAFETY PRACTICES.

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

STANDARD 2

12% of Exam Content

◆ STUDENTS WILL INVESTIGATE CAREER OPPORTUNITIES WITHIN THE WORLD OF ENGINEERING.

- Objective 1: Identify occupations related to Engineering.
- Objective 2: Differentiate among various Engineering disciplines.
- Bioengineering
 - Chemical Engineering
 - Civil and Environmental Engineering
 - Computer Engineering
 - Electrical Engineering
 - Mechanical Engineering
 - Materials Science
- Objective 3: Investigate different types of occupational training and educational opportunities.



STANDARD 3

12% of Exam Content

◆ STUDENTS WILL UNDERSTAND AND DEVELOP POSITIVE WORK ETHICS, COMMUNICATION SKILLS, AND LEADERSHIP SKILLS.

- Objective 1: Demonstrate positive work ethics and leadership skills.
- Responsibility
 - Reliability
 - Dependability
 - Effective Communication
 - Delegation
 - Cooperation
 - Teamwork
 - Integrity
- Objective 2: Employ the Technology Student Association (TSA) student organization's program as an integral element of the curriculum.
- Objective 3: Participate in problem-solving, both individually and as part of a team.
- Objective 4: Understand the importance of inter-disciplinary teams.
- Objective 5: Take minutes of a team meeting.
- Objective 6: Make accurately proportioned sketches using correct drawing conventions.
- Notes are neat and legible.
 - Objects should be drawn to correct proportions.
 - Dimensions are used appropriately.
 - Views can be isometric, orthogonal, sections, or assemblies.
- Objective 7: Create and utilize an engineering notebook per established conventions.
- Sequential and chronological
 - Accurate and complete reflection of the progress being recorded
 - Sketches or pictures are included where appropriate
 - No loose entries or pages
 - Each page is dated and witnessed
 - Unused spaces are identified and lined out
 - Errors are not erased or obliterated
 - Test data and calculations are included

STANDARD 4

30% of Exam Content

◆ STUDENTS WILL IDENTIFY THE QUALITIES OF SUCCESSFUL ENGINEERING DESIGN, RECOGNIZE ITS ROLE IN SOCIETY, AND DEVELOP PROJECTS USING AN ENGINEERING DESIGN PROCESS.

- Objective 1: Identify the qualities of good design and their relationship to the design's user.
- Objective 2: Examine a design with respect to its quality and usability.
- Objective 3: Understand that these qualities are the result of choices made and constraints applied during the design process.
- Objective 4: Recognize and identify the role of engineering and engineered products in society.



- Objective 5: Identify the requirements for and role of intellectual property in design.
- Objective 6: Recall education requirements for professional success as a designer/engineer.
- Objective 7: Identify and explain the elements of an engineering design process.
- Identify & define the design problem
 - Brainstorm solutions
 - Create models & build a prototype
 - Test the prototype
 - Redesign and optimize
- Objective 8: Understand the concept of a problem statement and design requirements.
- Objective 9: Create design specifications considering such factors as:
- Performance
 - Time and financial constraints
 - Ergonomics
 - Safety
 - The state-of-of the art
- Objective 10: Translate design requirements into a design solution.
- Objective 11: Use brainstorming methods to identify solutions to a design problem.
- Objective 12: Recognize and demonstrate that there are many possible successful designs and that a design process does not always result in a single best design.
- Objective 13: Explain the role of and be able to utilize mathematical and functional modeling in the creation and assessment of a design.
- Objective 14: Perform a design-of-experiments.
- Objective 15: Build and test designs against design specifications, evaluate the results of those tests, and present their analyses.
- Objective 16: Demonstrate that design is an iterative process, subject to continuous evolutionary improvement.

STANDARD 5

12% of Exam Content

STUDENTS WILL UNDERSTAND WAYS IN WHICH CIVIL ENGINEERING CAN ENHANCE HEALTH AND WELL-BEING OF INDIVIDUALS.

- Objective 1: Identify several different careers that support large scale civil or environmental projects.
- Transportation Engineering
 - Structural Engineering
 - Construction Engineering
 - Environmental Engineering
 - Geotechnical Engineering
 - Water Resources Engineering
- Objective 2: Use idealized equations that are fundamental to Civil Engineering.
- Hydrostatic pressure from density and height.
 - Flow velocity in an ideal (frictionless) system using Bernoulli's equation.
 - Internal forces in a simple truss structure.



- Objective 3: Describe how real world factors change performance from the ideal to:
- Water tower height affects pressure driving force.
 - Pressure driving force affects flow rate from a pipe.
 - Fittings, bends, pipe length, and pipe diameter affect flow rate in a pipe.
- Objective 4: Work in teams to design and build a project related to Civil Engineering.
- Water distribution network
 - Tower building
- Objective 5: Write a reflection of the project.
- What was the objective
 - What worked
 - What didn't work and why it didn't
 - How did the design compare with the best and worst performers
 - What you would do differently
 - Was the objective accomplished
- Objective 6: Give a brief presentation on an existing or an emerging Civil Engineering technology.

STANDARD 6

14% of Exam Content

STUDENTS WILL UNDERSTAND WAYS IN WHICH COMPUTER ENGINEERING CAN ENHANCE HEALTH AND WELL-BEING OF INDIVIDUALS.

- Objective 1: Identify several different careers that support the computer industry.
- Computer hardware design
 - Network design
 - Network management
 - Programming
 - Systems support
- Objective 2: Identify the main internal and external components of a computer.
- Memory
 - Processor
 - Video and Sound
 - Input peripherals
 - Output peripherals
- Objective 3: Explain the basic components of a computer's programming design.
- Purpose of software
 - Difference between software and data
 - Purpose of computer programming languages
- Objective 4: Understand various elements of coding structure.
- Explain the difference between a variable's name and its value.
 - Predict the results of code snippets which use.
 - Variables
 - Operators
 - Branching structures
 - Looping structures
 - Function calls



- Objective 5: Work in teams to design and build a project related to Computer Engineering.
- Pinball game
 - Rehabilitation therapy game
- Objective 6: Write a reflection of the project.
- What was the objective
 - What worked
 - What didn't work and why
 - How did the design compare with the best and worst performers
 - What would you do differently
 - Was the objective accomplished
- Objective 7: Work in teams to design and build a project related to Computer Engineering.

STANDARD 7

12% of Exam Content

STUDENTS WILL UNDERSTAND WAYS IN WHICH ELECTRICAL ENGINEERING CAN ENHANCE HEALTH AND WELL-BEING OF INDIVIDUALS.

- Objective 1: Identify several different careers that support the electrical or electronics industry.
- Power
 - Control
 - Electronics
 - Microelectronics
 - Signal Processing
 - Telecommunications
 - Instrumentation
 - Mechatronics
- Objective 2: Define and explain the following electronic terms and concepts.
- Electricity
 - Electronics
 - Conductor
 - Insulator
 - Semi-conductor
 - Series circuit
 - Parallel circuit
 - Voltage
 - Resistance
 - Current
- Objective 3: Explore the fundamentals of atomic theory as it relates to electricity.
- The electron's role in electricity.
 - The difference between an insulator and a conductor and be able to identify common examples of each.
- Objective 4: Use idealized equations that are fundamental to Electrical Engineering.
- Ohm's law to calculate current, voltage or resistance in simple circuits.
 - Kirchhoff's voltage law and understand how it applies to simple circuits.
 - Kirchhoff's current law and understand how it applies to simple circuits.
 - Watt's law to calculate current, voltage or power.
- Objective 5: Assemble an electronic circuit and understand the use of schematics, function of basic electronic components, and electronic measurement.



Objective 6: Work in teams to design and build a project related to Electrical Engineering.

- LED Light Display

Objective 7: Write a reflection of the project.

- What was the objective
- What worked
- What didn't work and why it didn't
- How did the design compare with the best and worst performers
- What you would do differently
- Was the objective accomplished

Objective 8: Give a brief presentation on an existing or an emerging Electrical Engineering technology.

