Unit 1.1: Introduction to Electronics

Content Area: **Science**
Course(s): **Digital Electro**
Time Period: **Semester 1**
Length: **3 weeks**
Status: **Published**

Standards

TEC.9-12.8.1.12	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge. Information accessed through the use of digital tools assists in generating solutions and making decisions.

Enduring Understandings

Understandings

Students will understand that ...

1. Safety is an important concept that must be considered at all times. Safety considerations can affect the individual, class, and overall environment of the classroom/laboratory.
2. Electricity, even at the nominal levels used in this curriculum, can cause bodily harm or even death.
3. Engineers and technicians use scientific notation, engineering notation, and Systems International (SI) notation to conveniently write very large or very small numbers frequently encountered when working with electronics.
4. The concepts of voltage, current, and resistance are related to one another and can be calculated using circuit theory laws.
5. The series or parallel arrangement of components in a circuit affects current, voltage, and resistance across the component. These values can be calculated and verified through measurement.
6. Engineers utilize measurement instrumentation and equipment such as Digital Multimeters (DMM), oscilloscopes, and function generators to verify designs and the functions of a circuit.
7. Resistors, capacitors, and light emitting diodes (LEDs) are common analog indicators in digital circuits.
8. Seven-segment displays are used to display the digits 0-9 as well as some alpha characters.
9. The two varieties of seven-segment displays are common cathode and common anode.
10. The input and output values of combinational and sequential logic function differently.
11. Combinational logic designs implemented with AND gates, OR gates, and INVERTER gates are referred to as AOI designs.
12. The flip-flop is the fundamental building block of sequential logic.
13. Logic gates are depicted by their schematic symbol, logic expression, and truth table.
14. Integrated circuits are categorized by their underlying circuitry, scale of integration, and packaging style.
15. Transistor-Transistor Logic (TTL) gates are available in a series of sub-families, each having their own advantages and disadvantages related to speed and power.
16. Soldering is an important skill/process specifically related to working in electronics.

Essential Questions

Students will keep considering ...

1. Why are the safety considerations and best practices associated with working in electronics important?
2. How are calculations and measurement used to design and verify circuit characteristics?

3. What are the functions of the most common analog and digital components used in electronics?
4. What are the technical skills and processes that are utilized throughout electronics?

Knowledge and Skills

Knowledge

Students will …

1. Recognize safety hazards associated with electrical circuits and know the best practices of working safely in an electronics lab environment.
2. Identify the equipment and know how to effectively use the equipment in an electronics lab.
3. Know scientific notation, engineering notation, and System International (SI) notation.
4. Know formulas for Ohm's Law, Kirchhoff's Voltage Law, and Kirchhoff's Current Law.
5. Know the characteristics of series and parallel sections of a circuit.
6. Identify digital and analog components and recognize the schematic symbol representation.
7. Know resistor color codes for labeling values.
8. Know capacitor labeling codes.
9. Know the characteristics of LEDs and how to locate LED datasheets.
10. Recognize combinational logic gates.
11. Recognize sequential logic gates.
12. Recognize types of integrated circuits and know where to find manufacturer data sheets.
13. Relate schematic symbols to logic gates and logic gates to schematic symbols.
14. Relate truth tables to logic gates and logic gates to truth tables.
15. Know base 2 and base number systems.
16. Know the best practices of soldering and de-soldering components.

Skills

Students will …

1. Practice proper safety and best practices while working with electronics.
2. Accurately take measurements with a Digital Multimeter (DMM).
3. Express numbers in scientific notation, engineering notation, and System International (SI) notation.
4. Solve for unknown values within circuits (series, parallel, and combination circuits) using Ohm's Law, Kirchhoff's Voltage Law, and Kirchhoff's Current Laws.
5. Utilize Circuit Design Software (CDS) and validate hand calculations of analog circuit solutions.
6. Identify and describe the function of common components used in electronics.
7. Demonstrate series and parallel circuits on a breadboard.
8. Identify a resistor's nominal value by reading its color code.
9. Measure a resistor's actual value by reading its resistance with a Digital Multimeter (DMM).
10. Identify a capacitor's nominal value by reading its labeled nomenclature.
11. Identify commonly used electronic components given their part number or schematic symbol.
12. Obtain manufacturer datasheets and extract information for components commonly used in digital electronics.
13. Identify various integrated circuit (IC) package styles.
14. Recognize the fundamental differences between combinational and sequential logic.
15. Identify and describe the function of AND, OR, and INVERTER gates.
16. Convert numbers between the binary and decimal number systems.
17. Count from 0-15 in binary.
18. Demonstrate proper soldering/de-soldering techniques to solder and de-solder components on a printed circuit board.

19. Properly tin the tip of a soldering iron and distinguish good solder joints from bad solder joints.

Resources

Technology Resources

- National Instruments Multiim circuit design and simulation software
- Microsoft Office Applications

Electronics Resources

- Electronics Trainers (power supply, function generator, breadboard)
- Electronics hand tools (diagonal cutters, needle-nosed pliers, wire strippers, etc.)
- Digital Multimeters

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing