Unit 3.1: Sequential Logic Circuit Design

Content Area: **Science**
Course(s): **Digital Electro**
Time Period: **Semester 2**
Length: **3 weeks**
Status: **Published**

Standards

TEC.9-12.	Technology products and systems impact every aspect of the world in which we live.
TEC.9-12.8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing and other technical methods of illustration.
TEC.9-12.8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
	Effective use of digital tools assists in gathering and managing information.

Enduring Understandings

Understandings

Students will understand that ...

1. The flip-flop and transparent latch are logic devices that have the capability to store data and can act as a memory device.
2. Flip-flops and transparent latches have both synchronous and asynchronous inputs.
3. Flip-flops can be used to design single event detection circuits, data synchronizers, shift registers, and frequency dividers.
4. The inputs on flip-flops can be activated with high signals, low signals, the leading edge of a clock wave, or the trailing edge of a clock wave.

Essential Questions

Students will keep considering ...

1. What are flip-flops and transparent latches and how do they function to store data?
2. What are some of the differences between synchronous and asynchronous inputs on flip-flops?
3. What are some of the ways a flip-flop can be triggered?
4. What are some of the common applications of flip-flops?

Knowledge and Skills

Knowledge

Students will ...

1. Know the schematic symbols and excitation tables for the D and J/K flip-flops.

2. Describe the function of the D and J/K flip-flops.
3. Describe the function of, and differences between, level sensitive and edge sensitive triggers.
4. Describe the function of, and differences between, active high and active low signals.
5. Describe the function of, and differences between, a flip-flop's synchronous and asynchronous inputs.

Skills

Students will ...

1. Draw detailed timing diagrams for the D or J/K flip-flop's Q output in response to a variety of synchronous and asynchronous input conditions.
2. Analyze and design introductory flip-flop applications such as event detection circuits, data synchronizers, shift registers, and frequency dividers.
3. Use Circuit Design Software (CDS) and a Digital Logic Board (DLB) to simulate and prototype introductory flip-flop applications.

Assessments

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

Modifications

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

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
- Digital Transistor-Transistor Logic (TTL) integrated circuits
- TTL Chip Checker
- Dual Channel Oscilloscope
- Digital/Analog Function Generator