High School PLTW Digital Electronics Curriculum

Course Description: This course covers fundamentals of analog and digital electronics. Students learn about the different number systems used in the design of digital circuitry. They design circuits to solve open-ended problems, assemble their solutions and trouble-shoot them as necessary. Students then use combined logic, integrated circuits and microprocessors to solve open-ended problems. © 2014 Project Lead The Way

Scope and Sequence:

Unit
Foundation in Electronics
Combinational Logic
Sequential Logic
Controlling Real World Systems

Unit 1: Foundations in Electronics

Subject: PLTW Civil Engineering and Architecture
Grade: 11 - 12
Name of Unit: Foundations in Electronics
Overview of Unit: In Unit 1 Foundations in Electronics, students will explore the fundamental components, concepts, equipment, and skill sets associated with circuit design. They will learn an engineering design process that can be used to guide the creation of circuits based on a set of design requirements. Throughout the course students will learn about advancements in circuits and circuit design that have shaped the world of digital electronics.

Topic 1: Foundations in Electronics

Activity	Title
Lesson 1.1	Introduction to Electronics
Lesson 1.2	Introduction to Circuit Design

Unit 2: Combinational Logic

Subject: PLTW Civil Engineering and Architecture
Grade: 11 - 12
Name of Unit: Combinational Logic
Overview of Unit: How do you design a circuit to "do what you want it to do"? The goal of Unit 2 is for students to gain in-depth understanding of the combinational logic circuit design. Student will explore creation of circuits with discrete components and how to simplify these circuits to implement more efficient designs.

Topic 1: Combinational Logic

Activity	Title
Lesson 2.1	AOI Combinational Logic Circuit Design
Lesson 2.2	Alternative Design: Universal Gates and K-Mapping
Lesson 2.3	Specific Combinational Logic Designs
Lesson 2.4	Introduction to Programmable Logic Devices (PLDs)

Unit 3: Sequential Logic

Subject: PLTW Civil Engineering and Architecture
Grade: 11 - 12
Name of Unit: Sequential Logic
Overview of Unit: How do you get a circuit to do what you want it to do, when you want it to do it? Sequential logic introduces students to event detection and memory. Sequential logic has two characteristics that distinguish it from combinational logic. First, sequential logic must have a signal that controls the sequencing of events. Second, sequential logic must have the ability to remember past events.

A keypad on a garage door opener is a classic example of an everyday device that utilizes sequential logic. On the keypad, the sequencing signal controls when a key can be pressed. The need to enter the passcode in a specific order necessitates memory of past events.

These characteristics are made possible by a simple device called a flip-flop. The flip-flop is a logic device that is capable of storing a logic level and allowing this stored value to change only at a specific time. For this reason the flip-flop is the fundamental building block for all sequential logic designs.

Topic 1: Sequential Logic

Activity	Title
Lesson 3.1	Sequential Logic Circuit Design
Lesson 3.2	Asynchronous Counters
Lesson 3.3	Synchronous Counters

Unit 4: Controlling Real World Systems

Subject: PLTW Civil Engineering and Architecture
Grade: 11 - 12
Name of Unit: Controlling Real World Systems
Overview of Unit: In Unit 4 students make the final transition from the transistor, to logic gates, to integrated circuits, to PLDs, to the microcontrollers and computers used widely today. State machines and embedded controllers allow student to integrate sensors and motors. This allows us to create circuits that exist in the world around us.

Topic 1: Controlling Real World Systems

Activity	Title
Lesson 4.1	Introduction to State Machines
Lesson 4.2	Introduction to Microcontrollers