Curriculum Framework (2015-2016) – Digital Electronics
Unit 3 Sequential Logic – Lesson 3.1 Sequential Logic Circuit Design

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- G5 – Demonstrate an ability to use the techniques, skills, and

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 – Understand and describe how sequential logic designs hold or store bits of data.
- T2 – Distinguish between different logic devices used in sequential logic circuits. Describe the advantages and disadvantages of each when utilizing in a digital design.
- T3 – Implement commonly used sequential circuit designs to execute tasks used regularly in electronics.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – The flip-flop and transparent latch are logic devices that have the capability to store data and can act as a memory device.
- U2 – Flip-flops and transparent latches have both synchronous and asynchronous inputs.
- U3 – Flip-flops can be used to design single event detection circuits, data synchronizers, shift registers, and frequency dividers.
- U4 –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 …*

- Q1 – What are flip-flops and transparent latches and how do they function to store data?
- Q2 – What are some of the differences between synchronous and asynchronous inputs on flip-flops?
- Q3 – What are some of the ways a flip-flip can be triggered?
- Q4 – What are some of the common applications of flip-flops?

Format guided by: Wiggins, G. & McTighe, J. (2011). The understanding by design guide to creating high quality units. Alexandria. VA: ASCD

	Acquisition	
modern engineering tools necessary for engineering practice. • G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. • G7 – Demonstrate an understanding of professional and ethical responsibility. • G8 – Demonstrate an ability to function on multidisciplinary teams. • G9 – Demonstrate an ability to communicate effectively. • G10 – Gain knowledge of contemporary issues. • G11 – Recognize the need for, and develop an ability to engage in life-long learning.	***KNOWLEDGE:*** *Students will…* • K1 – Know the schematic symbols and excitation tables for the D and J/K flip-flops.U1,U2 • K2 – Describe the function of the D and J/K flip-flops.U3 • K3 – Describe the function of, and differences between, level sensitive and edge sensitive triggers.U4 • K4 – Describe the function of, and differences between, active high and active low signals.U4 • K5 – Describe the function of, and differences between, a flip-flop's synchronous and asynchronous inputs.U2	***SKILLS:*** *Students will…* • S1 – 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.U2,U3,U4 • S2 – Analyze and design introductory flip-flop applications such as event detection circuits, data synchronizers, shift registers, and frequency dividers.U3 • S3 – Use Circuit Design Software (CDS) and a Digital Logic Board (DLB) to simulate and prototype introductory flip-flop applications.U3,U4

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning	Activities (A) Projects (P) Problems(B)	Knowledge and Skills
3.1.1.A Sequential Logic: D Flip-Flops and J/K Flip-Flops	• Student responses to examples in presentation 3.1.1 Sequential Logic: D Flip-Flops and J/K Flip-Flops • Essential Questions	• Print out of simulated circuits • Conclusion Questions • Demonstration of simulated circuit	3.1.1.A Introduction to Latches and Flip-Flops	K1,K2,K3,K4,K5,S1,S2,S3
3.1.2.A Flip-Flop Applications: Event Detection	• Student responses to examples in presentation 3.1.2 Flip-Flop Applications: Event Detection • Essential Questions	• Print out of simulated circuits • Conclusion Questions • Demonstration of completed circuit	3.1.2.A Flip-Flop Applications: Event Detection	K1,K2,K3,K4,K5,S1,S2,S3
3.1.3.A Flip-Flop Applications: Shift Registers	• Student responses to examples in presentation 3.1.2 Flip-Flop Applications: Event Detection • Essential Questions	• Print out of simulated circuits • Conclusion Questions • Demonstration of completed circuit	3.1.3.A Flip-Flop Applications: Shift Registers	K1,K2,K3,K4,K5,S1,S2,S3

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