Curriculum Framework – Digital Electronics (2015-2016)
Unit 3 Sequential Logic – Lesson 3.2 Asynchronous Counters

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 modern engineering tools

Transfer

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

- T1 – Design and implement common types of asynchronous counters used in electronics and recognize where these types of counters might be applied in a digital circuit.
- T2 – Distinguish between the different levels of integration a designer can use in selecting logic gates for an asynchronous counter.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – Asynchronous counters, also called ripple counters, are characterized by an external signal clocking the first flip-flop. All subsequent flip-flips are clocked by the output of the previous flip-flop.
- U2 – Asynchronous counters can be implemented using small scale integrated (SSI) and medium scale integrated (MSI) logic gates.
- U3 – Asynchronous counters can be implemented with either D or J/K flip-flops.
- U4 – Up counters, down counters, and modulus counters all can be implemented using the asynchronous counter method.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 – How can D flip-flops or J/K flip-flops be arranged in order to create a desired asynchronous clock signal?
- Q2 – How would you use a design process to create asynchronous counters using small scale integration (SSI) and medium scale integration (MSI)?
- Q3 – Why is it important to have a counter/start at specific values?
- Q4 – How can an asynchronous counter be designed to start and stop/repeat a count at the desired values?

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	Acquisition	
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 – Recognize asynchronous counters.U1 • K2 – Recognize that asynchronous counters are commonly referred to as ripple counters.U1 • K3 – Recognize small scale integration (SSI) logic gates.U2 • K4 – Recognize medium scale integration (MSI) logic gates.U2 • K5 – Arrange asynchronous counters to count up or down over a specified range.U4	***SKILLS:*** *Students will…* • S1 – Describe the advantages and disadvantages of counters designed using the asynchronous counter method.U1 • S2 – Describe the ripple effect of an asynchronous counter.U1 • S3 – Analyze and design up, down, and modulus asynchronous counters using discrete D and J/K flip-flops.U4 • S4 – Analyze and design up, down, and modulus asynchronous counters using medium scale integrated (MSI) circuit counters.U2,U4 • S5 – Describe where a count starts and where a count stops/repeats on a modulus asynchronous counter.U4 • S6 – Use Circuit Design Software (CDS) and Digital Logic Board (DLB) to simulate and prototype SSI and MSI asynchronous counters.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
3.2.1.A Asynchronous Counters: SSI Up and Down Counters	• Student responses to examples in presentation 3.2.1 Asynchronous Counters: SSI Up and Down Counters • Essential Questions	• Print out of simulated circuits • Conclusion Questions. • Demonstration of completed circuit	3.2.1.A Asynchronous Counters: SSI Up and Down Counters	K1,K2,K3,K5,S1,S2,S3, S6
3.2.2.A Asynchronous Counters: SSI Mod Counters	• Student responses to examples in presentation 3.2.2 Asynchronous Counters: SSI Mod Counters • Essential Questions	• Print out of simulated circuits. • Conclusion Questions. • Demonstration of completed circuit	3.2.2.A Asynchronous Counters: SSI Mod Counters	K1,K2,K3,K5,S1,S2,S3, S5,S6
3.2.3.A Asynchronous Counters: MSI Suspend and Reset Count	• Student responses to examples in 3.2.3 Asynchronous Counters: MSI Suspend and Reset Count • Essential Questions	• Print out of simulated circuits • Conclusion Questions. • Demonstration of completed circuit	3.2.3.A Asynchronous Counters: MSI Suspend and Reset Count	K4,K5,S5,S6
3.2.4.A Asynchronous Counters: Now Serving Display	• Essential Questions	• Print out of simulated circuits • Conclusion Questions. • Demonstration of completed circuit	3.2.4.A Asynchronous Counters: Now Serving Display	K5,S6

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