Curriculum Framework – Digital Electronics (2015-2016)
Unit 3 Sequential Logic – Lesson 3.3 Synchronous 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

Transfer

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

- T1 – Design and implement common types of synchronous 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 a synchronous counter.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – Synchronous counters, also called parallel counters, are characterized by an external signal clocking all flip-flops simultaneously.
- U2 – Synchronous counters can be implemented using small scale integrated (SSI) and medium scale integrated (MSI) logic gates.
- U3 – Synchronous 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 synchronous 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 synchronous clock signal?
- Q2 – How would you use a design process to create synchronous 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 a synchronous counter be designed to start and stop/repeat a count at the desired values?

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	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 – Recognize synchronous counters.U1 • K2 – Recognize small scale integration (SSI) logic gates.U2 • K3 – Recognize medium scale integration (MSI) logic gates.U2 • K4 – Arrange synchronous counters to count up or down over specified ranges.U3,U4	***SKILLS:*** *Students will…* • S1 – Describe the advantages and disadvantage of counters designed using the synchronous counter method.U1 • S2 – Analyze and design up, down, and modulus synchronous counters using discrete D and J/K flip-flops.U2,U3,U4 • S3 – Analyze and design up, down, and modulus synchronous counters using medium scale integrated (MSI) circuit counters.U2,U3,U4 • S4 – Describe where a count starts and where a count stops/repeats on a modulus synchronous counter.(U4) • S5 – Use Circuit Design Software (CDS) and Digital Logic Board (DLB) to simulate and prototype SSI and MSI synchronous counters(U2,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
3.3.1.A Synchronous Counters: SSI	• Essential Questions	• Print out of simulated circuits • Conclusion Questions • Demonstration of completed circuit	3.3.1.A Synchronous Counters: SSI	K1,K2,K4,S1,S2,S5
3.3.2.A Synchronous Counters: MSI '163 Up Counter	• Essential Questions	• Print out of simulated circuits • Conclusion questions • Demonstration of completed circuit	3.3.2.A Synchronous Counters: MSI '163 Up Counter	K3,K4,S3,S4,S5
3.3.3.A Synchronous Counters: MSI '193 Up/Down Counter	• Essential Questions	• Print out of simulated circuits • Conclusion Questions • Demonstration of completed circuit	3.3.3.A Synchronous Counters: MSI '193 Up/Down Counter	K3,K4,S3,S4,S5
3.3.4.B Synchronous Counters: Sixty Second Timer	• Essential Questions	• Print out of simulated circuits • Conclusion Questions. • Demonstration of completed circuit	3.3.4.B Synchronous Counters: Sixty Second Timer	K4,S5

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