CST K145 Digital Circuits & Logic Syllabus

Class Format: Hybrid (approximately half classroom and half online)

Hours: Lecture W 2:30 pm–4:10 pm (Room B/227)

Instructors: Allan Anderson and George Volkov
Private Contact Methods: Blackboard Learn Messaging (preferred) *or* aanderson@trcc.commnet.edu and gvolkov@trcc.commnet.edu (emergency only) for private (student-to-instructors) communications
Public Blackboard Discussions: all students and instructor communications on class topics – this is the primary class communication method outside of the classroom
Campus Office Hours: Anderson: Wednesday (12:30-2:15 & 4:15-5:30), other days/hours by appointment
Volkov: by appointment only (typically before or after class)
Campus Office: Anderson: Room C/106, Volkov: B/227
Campus Phone: Anderson: (860) 215-9403 (with voice mail), Volkov: none
Instructor Response Time Objectives: Electronic Messages - 48 hours (weekdays), 72 hours (weekends)
Discussion posts - 24 hours (weekdays), 48 hours (weekends)
Assignment grading – 1 week or less from due date (no assignments are graded before the due date)
Phone messages – 72 hours (weekdays), 96 hours (weekends)

Dates: Aug. 31st – Dec. 14th, no class on Nov. 23rd class, other days may also be designated as Blackboard only (no class meeting).

Textbook: M. Morris Mano and Michael D. Ciletti, *Digital Design – With An Introduction to the Verilog HDL, Fifth Edition*, Pearson, 2013, 978-0-13-277420-8

Software: This course will use the SynaptiCAD software (VeriLogger Extreme + BugHunter) for digital design assignments. Students will need to download this free software (instructions will be provided for a 6 month license) and install it on their own computer. In addition other no-charge software may be required during the semester.

Supplies and Materials: Removable media may be required. Specific usage will be covered in class so do not purchase before discussing this with the instructors.

Withdrawing from the course: A student who simply stops submitting work will receive a grade based on the submitted work only which will usually be a failing grade. To receive a "W" grade instead, apply for a withdrawal through the registrar's office by December 9th. A "W" will be entered on the student transcript.

Academic Integrity: Students are expected to do their own work in this class. Working together to better understand the material is acceptable. Submitting duplicate work is not and will adversely affect the assignment grade. Actively participating in the discussion boards both to ask and to answer questions is expected of all students. Posting of detailed instructions for "how to" responses to questions is encouraged but posting of a complete solution is not. Example violations include but are not limited to:

- Copying a file or any portion of a file from another student.
- Sharing or allowing another student to copy your files or any portion of a file.
- Duplicating or distributing copies licenses for software programs and/or services.

Class cancellations: as a hybrid class with meetings on campus, any college delay or closing due to weather or other circumstances will have impact on classroom based activities. However, there may be little to no impact on other scheduled activities for this class. Your instructor will inform you of any changes to existing dates.

Students with Disabilities: If you are a student with a disability and believe you will need support services and/or accommodations for this class, please contact the Disabilities Support Services at TRCC. Please note that the instructors cannot provide accommodations based upon disability until they have received an accommodation letter from a TRCC Disability Service Provider.

Basic Learning Outcomes:

- Learn number systems
- Learn Boolean theorem, logic gates and Karnough Maps
- Design combinational logic such as Multiplexer, Decoder, Adder and Subtractor
- Design sequential circuits
- Understand the function of various digital components such as registers, shift registers, and counters
- Learn characteristics of RAM and programmable logic devices
- Perform experiments using simulators

Course Objectives:

- To provide the student with guidelines for appropriate electronic communication techniques in a business/academic environment and the opportunity to use these techniques for class activities throughout the semester. Specifically this will include Blackboard class announcements, discussions, messages, assignment submissions, and other techniques as appropriate. In addition, this will include the opportunity to use your TRCC online learning portfolio in Digication for certain class activities. Using appropriate sources and formulating effective writing strategies will be embedded in all writing activities.
- To provide the student with knowledge of the fundamental concepts digital systems design.
- At course completion students will be able to describe, explain and discuss modern digital design features including but not limited to the following topics:

Digital Systems and Binary Numbers
- Digital Systems
- Machine Representation of Data
  - Binary Numbers
  - Number-Base Conversions
  - Octal and Hexadecimal Numbers
  - Complements of Numbers
  - Signed Binary Numbers
  - Binary Codes
  - Binary Storage and Registers
  - Binary Logic

Boolean Algebra and Logic Gates
- Basic Definitions
- Axiomatic Definition of Boolean Algebra
- Basic Theorems and Properties of Boolean Algebra
- Boolean Functions
- Canonical and Standard Forms
- Other Logic Operations
- Digital Logic Gates
- Integrated Circuits

Gate-Level Minimization
- The Map Method
- Four-Variable K-Map
- Product-of-Sums Simplification
- Don't-Care Conditions
- NAND and NOR Implementation
- Other Two-Level Implementations
- Exclusive-OR Function
- Hardware Description Language

Combinational Logic
- Combinational Circuits
- Analysis Procedure
- Design Procedure
- Binary Adder-Subtractor
- Decimal Adder
- Binary Multiplier
- Magnitude Comparator
- Decoders
- Encoders

Synchronous Sequential Logic
- Sequential Circuits
- Storage Elements: Latches
- Storage Elements: Flip-Flops
- Analysis of Clocked Sequential Circuits
- Synthesizable HDL Models of Sequential Circuits
- State Reduction and Assignment
- Design Procedure

Registers and Counters
- Registers
- Shift Registers
- Ripple Counters
- Synchronous Counters
- Other Counters
- HDL for Registers and Counters

Memory and Programmable Logic
- Introduction
- Random-Access Memory
- Memory Decoding
- Error Detection and Correction
- Read-Only Memory
- Programmable Logic Array
- Programmable Array Logic
- Sequential Programmable Devices

Lab Assignments: Weekly assignments from the end of chapter problems or from additional instructor handouts will be given. The hand-in format will be via Blackboard Learn unless otherwise noted. Class assignments should be submitted on or before the due date and time. A late assignment will lose 10% of the score for that assignment if submitted late. No assignments will be accepted after the cutoff date. Assignments will be graded on professionalism, accuracy, style and completeness. The details for each assignment, including work to be done and the due date and cutoff date, will be posted in Blackboard. Students are encouraged to interact with the instructors or other students on these assignments via Blackboard Learn discussion boards but must personally perform the necessary actions to complete the assignments.

Grading and Evaluation Criteria:

20 % of the grade is based on a final examination
30 % of the grade is based on chapter examinations
40 % of the grade is based on assigned labs
10% of the grade is based on discussion (classroom and online) participation and an instructor designated assignment for submission as a General Education artifact using Digication

Final course grades will be assigned as objectively as possible, according to the following scale (a class curve may be used at the discretion of the instructor):

90 - 100%	A- to A
80 - 89%	B- to B+
70 - 79%	C- to C+
60 - 69%	D- to D+
59% and Below	F

Course Outline:

Week	Topics – check Blackboard for details	Text Assignments
1-2	Digital Systems and Binary Numbers	Chapter 1
3-4	Boolean Algebra and Logic Gates	Chapter 2
5-6	Gate-Level Minimization	Chapter 3
7-8	Combinational Logic	Chapter 4
9-10	Synchronous Sequential Logic	Chapter 5
11-12	Registers and Counters	Chapter 6
13-14	Memory and Programmable Logic	Chapter 8
15		Final Exam

Note: The foregoing course outline is subject to change as conditions warrant.