Syllabus CST K145

Digital Circuits & Logic

Fall 2018

Course and Instructor Information

Course Title: Digital Circuits & Logic (CST K145)
Credits: 4
Format: Hybrid
Instructor: Patrick Burton
Location: B-227
Lab: W 1:30 – 3:10 pm
Email: pburton@trcc.commnet.edu
Office Hours/Availability: Monday (3:30 – 4:30pm)
Wednesday (12:15 – 1:15pm & 3:30 – 4:30pm)

This course may contain copyrighted information.

All information is subject to change at any time. Check the course **Blackboard Learn** page for announcements and updates.

Course Materials

Online version or physical textbook should be obtained before the first onsite meeting since it will be used throughout the semester for content, concepts, assignments, etc.

Digital Design: With an Introduction to Verilog HDL, VHDL, and SystemVerilog 6th Edition by M. Morris Mano & Michael D. Ciletti

ISBN-10: 0-13-454989-9

ISBN-13: 987-0-13-454989-7

Publisher: Pearson

Copyright: 2018

Additional course materials including lecture notes, links, assignments, and handouts will be posted on this courses site within **Blackboard Learn**.

Required Software/Supplies

Unless otherwise stated, the course **Blackboard Learn** site is required for all assignment submissions. Email or hard copy submission **will not be accepted.**

Homework Assignments and Documentation generation:

- Microsoft Office Word 2003+
- Microsoft Office PowerPoint 2003+
- Other drawing tool with artifacts submitted in a graphics format (*e.g.*, PNG or JPG)

This course will use the Logisim (http://www.cburch.com/logisim/) software for digital design assignments. Students will need to download this free software and install it on their own computer. In addition other no-charge software may be required during the semester.

Removable media is required. Specific usage will be covered in class so do not purchase before discussing this with the instructor.

Course Description

The course examines the fundamental concepts of digital logic design, digital circuits, and modern digital systems beginning with a history of computing, an explanation of binary number systems, and data representation, and progresses through logical design into PC systems.

Logic design exercises and simulations are used to provide practical experience.

Specifically at the course completion students will be able to describe, explain, and discuss modern digital design features including but not limited to the following:

- 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
- 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

○ 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	• 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

Course Outline/Schedule

Week	Topics/Reading Assignments
1	**Chapter 1 – Digital Systems and Binary Numbers**
2	**Chapter 1 – Digital Systems and Binary Numbers**
3	**Chapter 2 – Boolean Algebra and Logic Gates**
4	**Chapter 2 – Boolean Algebra and Logic Gates**
5	**Chapter 3 – Gate-Level Minimization** **Test 1**
6	**Chapter 3 – Gate-Level Minimization**
7	**Chapter 4 – Combinational Logic**
8	**Chapter 4 – Combinational Logic**
9	**Chapter 5 – Synchronous Sequential Logic** **Test 2**
10	**Chapter 5 – Synchronous Sequential Logic**
11	**Chapter 6 – Registers and Counters**
12	**Chapter 6 – Registers and Counters**
13	**Chapter 7 – Memory and Programmable Logic**

14	**Chapter 7 – Memory and Programmable Logic** **Test 3**
15	**Final Project**

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

Course Requisites

1. **Attendance**: Students are expected to be punctual and responsible for all assigned text reading materials and any additional course content posted on the course **Blackboard Learn** site.
2. **Participation:** Active and positive class and online discussion participation is expected. A large part of the learning experience will come from discussion of problems and techniques presented in the reading, notes and from the homework assignments. Onsite/in-class is not the time to check your email, browse the web for your next purchase, or to play games.
3. **Reading: All reading assignments should be completed prior to the onsite lab time.**
4. **Assignments:** All assignments are to be your own work and are due by the **date and time** posted with the assignment on the course **Blackboard Learn** site.
5. **Homework:** Homework assignments will typically be assigned on a weekly basis. Homework assignments will generally consist of the various aspects of the reading and posted content concepts and/or related research items.
    a. Homework assignments are graded on ***both*** the quality of the required written documentation and on the quality of the actual computer code (*e.g.*, Logisim files), *etc*.
    b. To receive full credit, assignments must meet all requirements and specifications, ***and*** must do so within the quality guidelines described in the assignment text and class discussions.
    c. It is recommended that individuals start working on a homework assignment as soon as it is released, and ask questions several days before due if additional explanations are needed on a specific assignment.
6. **Electronic submission of assignments:** Written documentation and answers to questions pertaining to an assignment ***must*** be submitted using Microsoft Word 2003+ (**.doc** or **.docx**) formats unless otherwise specified.
    a. **All documentation, code, scripts, etc. shall be submitted electronically** using the appropriate course **Blackboard Learn** site assignment link.
    b. Remember, because clocks do not always match, you should be submitting your assignment at least 15 minutes before it is due. Extenuating circumstances should be discussed with the instructor **prior to the due date**.
    c. It is the student's responsibility to check before the deadline that the files they have uploaded have been effectively submitted and are not unreadable or corrupted. Students should check that their files have been correctly submitted by downloading them and testing that they can open and/or run the files.
7. **Quizzes/Tests:** Quizzes covering the material in the reading, assignments, and/or our discussions may be unannounced, while tests will be announced and scheduled at least a week in advance.

8. **Project**: There will be a circuit computing project that will encompass multiple facets of the material covered. To receive full credit, multiple submission milestones must be met along with a final presentation/demonstration of your circuit. Additional project and submission details will be provided via the course **Blackboard Learn** site.
9. The instructor reserves the right to change topics and dates accordingly as the semester progresses. All changes will be communicated in an appropriate manner (such as updates within **Blackboard Learn** site).

Course Grading

Late submissions of assignments are not accepted without penalty.

- You have up to 5 days after due date to submit with a **20%** penalty for each day.
- After 5 days, 0 points will be received for the submission.
- **Quizzes and Tests are as scheduled with no makeups.**
- **Final Projects are not accepted late.**
- Extenuating circumstances should be discussed with the instructor at least one week prior to any due date or as soon as feasible depending on the situation. Additionally, other college accepted correspondence or paperwork may be required for justification.

Summary of Course Grading:

Course Component	Weight
Participation	10%
Assignments/Homework	25%
Labs	25%
Quizzes/Tests	20%
Presentation	10%
Project	10%

Grading Scale:

Grade	Letter Grade
93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-66	D

60-62	D-
<60	F

Student Responsibilities

Online Learning Portfolio

All students are required to maintain an online learning portfolio in Digication that uses the college template, in as much as it is pertinent and supported by outcome products of this course. Through this electronic tool students will have the opportunity to monitor their own growth in college-wide learning. The student will keep his/her learning portfolio and may continue to use the Digication account after graduation. A Three Rivers General Education Assessment Team will select and review random works to improve the college experience for all. Student work reviewed for assessment purposes will not include names and all student work will remain private and anonymous for college improvement purposes. Students will have the ability to integrate learning from the classroom, college, and life in general, which will provide additional learning opportunities. If desired, students will have the option to create multiple portfolios.

Withdrawing from the Course

A student who simply stops submitting work will receive the grade earned on that work, usually a failing grade. To receive a "W" grade instead, apply for a withdrawal by May 4th. A "W" will be entered on the student transcript. An "N" (implicit withdrawal) may be entered for a student that stops submitting work before 60% of the class is completed but it will still show up as an "F" on your 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. Example violations include but are not limited to:

- Copying or sharing 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 of licenses for software programs and/or services.

Any and all exams, papers or reports submitted by you and that bears your name is presumed to be your own original work that has not previously been submitted for credit in another course unless you obtain prior written approval to do so from your professor.

In all of your assignments, including homework or drafts of papers, you may use words or ideas written by other individuals in publications, web sites, or other sources but only with proper attribution. "Proper attribution" means that you have fully identified the original source and extent of your use of the words or ideas of others that you reproduce in your work for this course, usually in the form of a footnote or parenthesis.

As a general rule, if you are citing from a published source or from a web site and the quotation is short (up to a sentence or two), place it in quotation marks; if you employ a longer passage from a publication or web site, please indent it and use single spacing. In both cases, be sure to cite the original source in a footnote or in parentheses. (See http://www.plagiarism.org/plag_article_how_do_I_cite_sources.html for more information on citing.)

If you are uncertain about the expectations for completing an assignment or taking a test or examination, be sure to seek clarification from your professor beforehand.

Finally, you should keep in mind that as a member of the Three Rivers Community College community, you are expected to demonstrate integrity in all of your academic endeavors and will be evaluated on your own merits.

Be proud of your academic accomplishments and help to protect and promote academic integrity. The consequences of cheating and academic dishonesty may include a formal discipline file, possible loss of financial scholarship or employment opportunities, and denial of admission to a four-year college.

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 instructor cannot provide accommodations based upon disability until the instructor has received an accommodation letter from the Disabilities Counselor.