Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: ELEC224 **Year:** 2025-2026

Course Title: Digital Electronics **Credit Hours:** 4

I. Course Description: Digital Electronics is the foundation of computer systems and automated manufacturing. This course provides theory and hands-on experience with digital logic and sequential circuits. Topics include number systems, Boolean logic, decoders, encoders, multiplexers, counters, shift registers and data conversion circuits. Laboratory experience will consist of demonstrating digital logic functions on a simulator then implementing the actual digital circuit on an FPGA project board programmed in VHDL. Prerequisites: prior completion of either ELEC126 or ELEC128 OR prior completion or concurrent enrollment in PHSC212. 4 Cr. (3 Lec. 3 Lab).

II. Additional Course Information:

1. This course is a prerequisite to ELEC244
2. This course is a technical elective for Engineering Science A.S.
3. This course is a technical elective for the Applied Science and Technology A.A.S.
4. This course has a course fee to cover the cost of lab materials and software license.

III. Student Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Work with number systems, recognize codes, and apply laws of Boolean Algebra.
2. Work with basic logic gates and programmable logic devices (FPGAs with VHDL).
3. Understand the use in a circuit and apply properties of Converters, Multiplexers, and Demultiplexers.
4. Understand and design Counter Circuits.
5. Understand the use in a circuit and apply properties of Flip Flops and Shift Registers.
6. Understand the interface between Digital and Analog Electronics.

IV. Tompkins Cortland Institutional Learning Outcomes; Program Learning Outcomes; SUNY General Education Outcomes

Tompkins Cortland ILOs

Complete this section for “service” courses only (e.g. courses that are required of all students; courses that are not program specific but satisfy liberal arts requirements; or commonly used in multiple academic programs to meet non-program-specific requirements). Check only Institutional Learning Outcomes (ILOs) that are meaningfully developed and assessed in this course. For each ILO chosen, include the SLO to which it aligns.

Students will:

☐ Communicate effectively, in oral and written forms, taking into consideration audience and purpose.

☐ Apply principles and methods of scientific inquiry and quantitative reasoning appropriate to their discipline.

☐ Use information, critical thinking, and the creative process to solve problems and reach conclusions.

☐ Use technology appropriate to their discipline.

☐ Describe the ways in which social, economic, or environmental sustainability depends on their own and the collective contributions of a diversity of ideas and people.

Program Learning Outcomes

Complete this section for program-specific courses (e.g. those that share the same 4 letter designation as the academic program or satisfy requirements in related programs). List the academic program(s) here and note which Student Learning Outcomes align to specific Programmatic Learning Outcomes. Please see the MCS Instructions for more details.

Specify the Academic Program
Applied Science and Technology A.A.S.

Upon successful completion of this program, a student should be able to demonstrate:

P1. An understanding of skills necessary in any technical profession;
N/A

P2. The application of standard laboratory procedures and protocols within the basic sciences;
N/A

P3. The ability to communicate effectively (using both the spoken and written word) within the technologies;
N/A

P4. A significant knowledge of how technology impacts society; and
N/A

P5. Practice of professional skills as applied to a technical area of expertise

S1. Work with number systems, recognize codes, and apply laws of Boolean Algebra.
S2. Work with basic logic gates and programmable logic devices (FPGAs with VHDL).
S3. Understand the use in a circuit and apply properties of Converters, Multiplexers, and De-multiplexers.
S4. Understand and design Counter Circuits.
S5. Understand the use in a circuit and apply properties of Flip Flops and Shift Registers.
S6. Understand the interface between Digital and Analog Electronics.

SUNY General Education Outcomes

If this course **assesses** a SUNY GEN ED Outcome, check all that apply and indicate which course outcome(s) address each checked item:

☐ CRITICAL THINKING - Students will:

a. identify, analyze, and evaluate arguments as they occur in their own or others' work; and
b. develop well-reasoned arguments.

☐ INFORMATION MANAGEMENT - Students will:

a. perform the basic operations of personal computer use;
b. understand and use basic research techniques; and
c. locate, evaluate and synthesize information from a variety of sources.

☐ GENERAL EDUCATION CATEGORY - Area(s):
For courses that are approved to meet one (or more) of the ten SUNY General Education categories, indicate which category the course fulfills, and which outcome(s) are aligned with the SUNY outcomes for that category:

☐ This course does not address any of the above Tompkins Cortland ILOs, PLOs, or SUNY General Education Outcomes.

V. Essential Topics/Themes

1. Number Systems and Codes
2. Basic Logic Gates
3. Programmable Logic Devices – FPGAs with VHDL
4. Boolean Algebra
5. Code Converters, Multiplexers, and De-multiplexers
6. Flip Flops
7. Counter Circuits
8. Shift Registers
9. Interfacing to the Analog World

VI. Methods of Assessment/Evaluation

Method	**% Course Grade**
1. Quizzes / Tests	20-40%
2. Homework	0-20%
3. Lab Reports	10-30%
4. Lab Performance Exams	10-20%
5. Final Exam	20-30%

VII. Texts – ☒ Required ☐ Recommended ☐ Used for more than one course (list courses)

1. *Digital Electronics: A Practical Approach with VHDL*. 9th edition. William Kleitz. Published by Pearson (July 14th 2021). Copyright © 2012. ISBN-13: 9780137546022

Editions listed are current as of date of syllabus. More recent editions may be used.

VIII. Bibliography of Supplemental Materials

1. *Digital Fundamentals.* 10E, Thomas Floyd, Pearson Publishing, ISBN 0132359235
2. *Digital Electronics.* 6E, Roger Tokheim, McGraw Hill Publishing, ISBN 0078289068
3. *Lab Manual for Digital Fundamentals,* 11th edition, Pearson, Thomas Floyd , ISBN: 0133514390
4. *Laboratory Manual (A Troubleshooting Approach) to Accompany Digital Electronics*. 8th Edition. Pearson College Div. by Michael Wiesner, Vance Venable, William Kleitz, ISBN 0132239825

Editions listed are current as of date of syllabus. More recent editions may be used.

IX. Other Learning Resources

Audiovisual:
Bill Kleitz (Author of the textbook) YouTube channel https://www.youtube.com/@BillKleitz
TinaDesignSuite YouTube channel https://www.youtube.com/@TinaDesignSuite

Electronic:
TinaCloud:
https://www.tinacloud.com/tinaui/tina.php
Intel Quartus Prime Lite-Edition Software v23.1 (or newer)
https://www.intel.com/content/www/us/en/products/details/fpga/development-tools/quartus-prime/resource.html
Intel FPGA Academy:
https://fpgacademy.org/

Other:

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for academic adjustments. All course materials are available in alternate formats upon request.*

Academic Integrity: *Every student at Tompkins Cortland Community College is expected to act in an academically honest fashion in all aspects of their academic work: in writing papers and reports, in taking examinations, in performing laboratory experiments and reporting the results, in clinical and cooperative learning experiences, and in attending to paperwork such as registration forms.*
Any written work submitted by a student must be their own. If the student uses the words or ideas of someone else, they must cite the source by such means as a footnote. Our guiding principle is that any honest evaluation of a

student's performance must be based on that student's work. Any action taken by a student that would result in misrepresentation of someone else's work or actions as the student's own — such as cheating on a test, submitting for credit a paper written by another person, or forging an advisor's signature — is intellectually dishonest and deserving of censure.

Several degree programs offer student learning opportunities (such as internships, field work, and clinical experiences) outside the standard classroom setting. As part of the learning process, students must understand and engage in conduct that adheres to principles guiding employment within the professional workplace. These behaviors include, but are not limited to, academic integrity, accountability, reliability, respect, use of appropriate language and dress, civility, professional ethics, honesty, and trustworthiness. Disciplinary action may be initiated for inappropriate conduct occurring while participating in any course-related project or event.