



## Official TCC Course Syllabus

Discipline Prefix: EGR	Course Number: 270	Course Title: Fundamentals of Computer Engineering	
	Course Section: D01B		
Credit Hours: 4	Lecture Hours: 3	Clinical Hours:	Lab Hours: 2
Contact Hours: 5	Studio Hours:	Semester: Fall 2014	
Meeting Days/Time/Location:	Mondays and Wednesdays 4:20 - 5:35 pm, H-164 Wednesdays, 1:00 – 3:00 pm, H-273		

### Instructor Information

Name: Paul E. Gordy, PE

Office Location: H-115, Advanced Technology Center

Office Hours: As posted on office door and on course Blackboard site

Contact Information: 757-822-7175

Course Website (optional): [www.faculty.tcc.edu/PGordy](http://www.faculty.tcc.edu/PGordy)

Blackboard site: <http://learn.vccs.edu>

Instructor email address (college or VCCS): [PGordy@tcc.edu](mailto:PGordy@tcc.edu)

## Course Information

### Course Description

Covers the design and organization of digital systems, including number systems, Boolean algebra, logic gates, Karnaugh maps, combinational and sequential logic circuits, timing diagrams, and synchronous and asynchronous controllers. Introduces hardware description language (HDL), FPGAs, microprocessors, and assembly language programming. Includes simulation using PSPICE.

### Prerequisites and/or Co-requisites

Prerequisite: EGR 125

Co-requisites: None

### General Education Core Competencies Supported by this Course

After completion of this course, students will be able to:

- **Communication**  
A competent communicator can interact with others using all forms of communication, resulting in understanding and being understood.
- **Critical Thinking**  
A competent critical thinker evaluates evidence carefully and applies reasoning to decide what to believe and how to act.
- **Information Literacy**  
A person who is competent in information literacy recognizes when information is needed and has the ability to locate, evaluate, and use it effectively.

- **Quantitative Reasoning**

A person who is competent in quantitative reasoning possesses the skills and knowledge necessary to apply the use of logic, numbers, and mathematics to deal effectively with common problems and issues. A person who is quantitatively literate can use numerical, geometric, and measurement data and concepts, mathematical skills, and principles of mathematical reasoning to draw logical conclusions and to make well-reasoned decisions.

- **Scientific Reasoning**

A person who is competent in scientific reasoning adheres to a self-correcting system of inquiry (the scientific method) and relies on empirical evidence to describe, understand, predict, and control natural phenomena.

## **Required Course Texts and Supplementary Materials**

**Textbook** - This course will follow the textbook somewhat closely. Reading assignments and problem assignments will generally be made from the textbook that will serve to reinforce concepts covered in the lectures. The textbook used in this course is: M. Moris Mano, Logic and Computer Design Fundamentals, 4<sup>th</sup> Edition, Upper Saddle River, NJ, Pearson Prentice-Hall, 2007 (ISBN: 978-0-13-600418-9)

## **Measurable Learning Outcomes**

- Represent numbers and perform arithmetic operations in various bases and convert between bases.
- Express, simplify, and minimize Boolean functions through various methods, including truth tables, Boolean algebra, and Karnaugh maps
- Implement logical expressions using defined logic functions.
- Analyze and synthesize combinational logic circuits
- Analyze and synthesize sequential logic circuits, including the use of state diagrams, state tables, excitation tables, and state equations.
- Implement logic circuits using Hardware Description Language (HDL) and Field Programmable Gate Arrays (FPGAs).
- Expose students to concepts in computer organization
- Simulate logic circuits and explore concepts in computer organization through the use of HDL and assembly language.

## **Topics Covered in the Course**

- Logic Expressions and Simplification
  - A. Boolean algebra
  - B. Logic gates & implementing logic expressions
  - C. Truth tables
  - D. Canonical forms and standard forms
  - E. Implicants, essential and prime
  - F. Reduction by Karnaugh maps (2-5 variable)
  - G. Product of Sums (POS) and Sum of Products (SOP) implementations
  - H. Don't care conditions
  - I. Multiple-level circuit implementation
  - J. Additional logic gates
- Logic Expressions and Simplification
  - A. Design procedure
  - B. Hierarchical design
  - C. Verification
  - D. Technology mapping (Ex: NAND and NOR implementations)
  - E. Rudimentary Logic Functions
  - F. Decoders and enabling

- G. Encoders, priority encoders, and multiplexers
- H. Implementing combinational logic functions using decoders and multiplexers
- I. Hardware Description Language (HDL) for combinational logic circuits
- Arithmetic Functions and Circuits
  - A. Binary addition, subtraction, and multiplication
  - B. Other arithmetic functions
- Sequential Circuits
  - A. Flip-flops and latches
  - B. Sequential circuit analysis
  - C. Mealy models and Moore models
  - D. State diagrams and state tables
  - E. Sequential circuit timing
  - F. Design of sequential circuits
  - G. Hardware Description Language (HDL) for sequential circuits
- Selected Design Topics
  - A. The Design Space
  - B. Gate propagation delay
  - C. Flip-flop timing and sequential circuit timing
  - D. ROM, Programmable Logic Devices (PLDs), and Field Programmable Gate Arrays (FPGAs)
- Registers and Counters
  - A. Registers and register operations
  - B. Synchronous and ripple counters
  - C. Asynchronous counters versus synchronous counters
- Memory
  - A. Tri-state devices
  - B. Random Access Memory (RAM)
- Lab Topics:
  - A. Lab #1 Introduction to Logic
  - B. Lab #2 Characteristics of TTL gates
  - C. Lab #3 Combinational Logic Circuits
  - D. Lab #4 7-segment displays, decoders and multiplexers
  - E. Lab #5 VHDL Combinational Logic Circuit
  - F. Lab #6 Sequential Counters
  - G. Lab #7 VHDL Sequential Logic Circuit
  - H. Lab #8 Assembly Language/MicroStamp 11

## **Description of Assignments/Assessments**

Homework Assignments – Individual assignments, mainly from the textbook

PSPICE Assignments – Individual assignments using PSPICE circuit analysis software (freeware).

Tests – Three tests based on the textbook, homework assignments and class notes

Final Exam – Comprehensive exam

Lab Reports – Some individual and some team labs. Lab grade is the average of the all lab report grades. All labs require demonstration of circuits to the instructor.

## **Course Schedule**

The following course schedule may change due to the progression of the course. The course schedule may change at the discretion of the instructor; however, students will be notified in writing when any changes/additions are made to the schedule.

- I. Digital Computers and Information (Chapter 1)
  - A. Digital systems