**EECE 2030 : Digital Electronics**

**Class Schedule:**  3 Credit course, meeting the equivalent of 3 - 50 minute class periods per week.

**Course Coordinator**: Susan C. Schneider

**Course Materials:**

**Required:** Stephen Brown and Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL Design, 3rd. ed.,* McGraw-Hill, 2009.

Frank Vahid, Digital Design, zyBook – interactive web-based textbook, Zynante (2016). \*\*Content from this book is reconfigured by the instructor to create the specific textbook used for EECE 2030.

Digilent Inc. Basys 3 Artix-7 FPGA Trainer Board

Xilinx, Vivado HLX Webpack, 2017.3 (Nov 2017) “

**Course Description:**

Introduces students to the basic principles of digital circuit analysis and design. Topics covered include: Boolean Algebra, number systems, basic logic gates, standard combinational circuits, combinational design, timing diagrams, flip-flops, sequential design, standard sequential circuits and programmable logic devices.

**Prerequisites:** none

**Required** for the Electrical Engineering and Computer Engineering programs and for the Bioelectronics and Biocomputing majors in the Biomedical Engineering program.

**Contribution to Professional Component:** Engineering Science 75%

Engineering Design 25%

**Course Goals:**

To enable students to understand the circuit behavior of electronic switching devices and to acquire the tools of analysis and design of combinational and sequential logic circuits.

**Course Objectives:**

*By the end of this course, you should....*

1. Know the basic postulates and theorems of Boolean algebra and how to use them
2. Know how to minimize logic expressions using

Boolean algebra,

Karnaugh Maps,

Computer Algorithms.

1. Be familiar with the symbols and functions of various combinational and sequential logic devices including (but not limited to):

AND, OR, NOT, XOR, XNOR, NAND, and NOR gates,

Flip-Flops (RS, JK, T, and D),

MSI and LSI logic devices such as MUXs, Encoders/Decoders, ROM, Counters,

Registers and PLDs.

1. Be able to design digital circuits using combinational and sequential logic devices to implement a specified function
2. Understand and be able to use timing diagrams as an analysis tool, a design tool and a troubleshooting tool
3. Be able to visualize a logic design problem from an initial problem statement in order to be able to develop a state diagram for the solution
4. Be able to translate a state diagram into a logic circuit design.
5. Be able to design, program and test simple combinational and sequential logic designs in VHDL using a development system.

**Contribution to Program Objectives:** partial fulfillment of Criterion 3 objectives A, B,C, E, G, I, K

**Digital Electronics Topics:**

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| EECE 2030 | Tentative Schedule  (from Brown & Vranesic  *Fundamentals of Digital Logic with VHDL Design)* | | |
| Section | Chapter | Chapter Title | Duration |
| 1 | 1 | Design Concepts | 2 weeks |
| 2 | Intro to Logic Circuits |
| 3 | Implementation Technology |
| 2 | 4 | Optimized Implementation of Logic Functions | 2 weeks |
| 5 (5.1 – 5.3) | Number Representation and Arithmetic Circuits |
| 3 | 5 | Number Representation and Arithmetic Circuits | 2 weeks |
| 6 | Combinational Circuit Building Blocks |
| 4 | 7 | Flip-flops, Registers, Counters and a Simple Processor | 3 weeks |
| 5 | 8 | Synchronous Sequential Circuits  (8.1, 8.3, 8.9) | 2 weeks |
| 6 | 8 | Synchronous Sequential Circuits  (8.2, 8.5-8.11) | 3 weeks |
| 7 | 10 | Digital System Design, Review | 1 week |