ECE 218 - Digital Systems

Credits: 4, **Contact Hours:** Two 75 minute lecture sessions per week, one 160 minute laboratory session per week.

Coordinator: S. Borkar, Senior Lecturer of ECE

Textbook: M.M.Mano and M.D.Ciletti, *Digital Design,* Pearson Prentice-Hall, 6th Ed., 2018. ISBN: 978-0-13-454989-7

2019 Catalog Data: ECE 218: Digital Systems. Prerequisites: Sophomore standing, Credit 3.
Number systems and conversions, binary codes, and Boolean algebra. Switching devices, discrete and integrated digital circuits, analysis and design of combinational logic circuits. Karnaugh maps and minimization techniques. Counters and registers. Analysis and design of synchronous sequential circuits. Concurrent registration in ECE 211 is strongly encouraged. (3-0-3)

Prerequisites or co-requisites by topic: Basic Circuit Analysis and Design

Enrollment: Required course for CPE and EE majors

Specific outcomes of instruction:
After completing this course, the student should be able to do the following:

1. Perform arithmetic in bases 2, 8, and 16.
2. Demonstrate the ability to apply Boolean algebra to digital logic problems.
3. Implement Boolean functions with logic gates.
4. Simplify Boolean functions using Karnaugh maps.
5. Design logic circuits from verbal problem descriptions.
6. Analyze situations where medium-scale integration circuits are useful.
7. Analyze and design logic circuits containing flip-flops.
8. Design and analyze synchronous sequential circuits.
9. List various types of memories and programmable logic devices.
10. Design Algorithmic State Machines

Relationship of ECE 218 specific outcomes of instruction to student outcomes:

	Student Outcomes	**Course Goals**
1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	1, 2, 3, 4, 5, 8, 9, 10
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	3, 6, 8, 10
3	An ability to communicate effectively with a range of audiences	3, 5, 8
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	6
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	2, 3, 4, 5, 7, 8, 9
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	2, 3, 4, 8, 9, 10

Topics:

- Number representation (1 week)
- Boolean Algebra, Logic Gates (1 week)
- Boolean Functions, Standard and Canonical Forms (1 week)
- Karnaugh maps (1 week)
- Don't care conditions, NAND/NOR implementations, Parity (1 week)
- Multilevel logic (1 week)
- Combinational logic circuits (1 week)
- Sequential Circuits, Flip-flops (1 week)
- Finite State Machines, Sequential circuit design (1 week)
- Registers (1 week)
- Shift Registers, Counters (1 week)
- RAM circuits (1 week)
- Programmable Devices (1 week)
- Design at Register Transfer Level (1 week)

Laboratory topics:

- Simple Circuits with Debugging Techniques (1 week)
- Functionality verification of Gates (1 week)
- Introduction to Digital Circuits (1 week)
- Code Conversion (2 weeks)
- Finite State Machine (2 weeks)
- Serial Adder (2 weeks)
- Counters (2 weeks)
- (optional) Sequential Logic Design with PLDs (1 week)
- (optional) Programmable Logic Array (1 week)

Prepared by: S. Borkar **Date:** February 27, 2020