ECE251

Course number and name: ECE251 Digital Design
Credits and contact hours 3 credits; 4 contact hours.
Instructor's or course coordinator's name Jacob Savir

Text books :

1. Alan B. Marcovitz, Introduction To Logic Design, 2nd edition (or higher), McGraw-Hill, ISBN # 0-07-286516-4.
2. John Carpinelli, **An Animated Introduction to Digital Logic Design** at https://digitalcommons.njit.edu/oat/1,

Other supplemental materials: Class notes

Specific course information

a. Catalog Description: The design of combinational and sequential logic circuits used in digital processing systems and computers. Basic register transfer operations are covered. Topics include Boolean algebra, minimization techniques and the design of logic circuits such as adders, comparators, decoders, multiplexers, counters, arithmetic logic units, and memory systems.
b. prerequisites or co-requisites: Phys 121
c. indicate whether a required, elective, or selected elective: required

Specific Course Learning Outcomes (CLO):

Students are able to

I. use Boolean Algebra.

II. minimize Boolean functions.

III. design digital circuits with gates, latches and flip flops.

IV. digital circuit in a multitude of possible applications.

Relevant student outcomes (ABET criterion 3):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO I, II, III, IV)
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. (CLO I, II, III, IV)

3. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO I, II, III, IV)

Brief list of topics to be covered:

Week 1: Number systems: decimal, binary, arbitrary radix representation.

Week 2: Representation of positive & negative numbers. Two's complement, One's complement, signed-magnitude, Hex, Octal, Ternary. Quick conversion between bases.

Week 3: Gates, truth tables, Boolean algebra, Function simplification.

Week 4: K-maps. Circuit implementation using K-maps. SOP and POS representation. NAND/NOR implementations.

Week 5: Mux, Demux, decoders, code conversion (BCD to Binary, Excess 3 to binary).

Week 6: Hazards, hazard-free design.

Week 7: Function implementation using MSI logic.

Week 8: Latches and Flip-flops: SR, D, JK, T.

Week 9: Counter design, register design, ALU function.

Week 10: Sequential circuits. Excitation function, state table, state diagram.

Week 11: Sequential circuit design with different flip-flops.

Week 12: Asynchronous circuits analysis and design. Excitation function, Flow table.

Week 13: PLDs, ROMs, PLAs, PALs.

Week 14: Review.