TENTATIVE Lecture and Lab Schedule for ECE 241F, 2018

Week	Topics covered	Textbook Sections	Lab Exercises
Sept 3	Overview of the course: topics covered, mark breakdown (midterm test, labs, final exam), overview of how the lab exercises are organized (students work in groups of two), marks assigned for preparation and lab performance); Quick overview of digital systems and Moore's law, examples of digital systems; Transistors as simple on-off switches	Chapter 1	
Sept 10	Project intro, videos Binary numbers, hex numbers Introduction to logic expressions; AND, OR, NOT circuits built using switches; AND, OR, NOT gate symbols; truth tables; simple example of logic circuit with AND, OR, NOT gates Boolean algebra: duality, axioms, rules, identities; proof of identities using perfect induction (i.e., truth tables); algebraic manipulation of Boolean expressions; timing diagrams; Venn Diagrams and their use to prove some identities Simple synthesis of logic circuits; sum-of-products (SOP) form; minterms; canonical SOP; product-of-sums form (POS); maxterms; canonical POS; examples of algebraic manipulation Intro to Lab 1	 3.1 2.1 – 2.4 2.5 2.6 B.5	
Sept 17	Example logic functions: 2-to-1 multiplexer, XOR gate, full-adder, ripple-carry adder, 7-seg; NAND and NOR logic networks; convert SOP to NAND-NAND, POS to NOR-NOR. Verilog introduction, including hierarchy	2.7, 2.8, 3.2 2.10, Appendix A	Lab 1: Building Circuits Using 7400-Series Chips Lab tutorial: Read on your own time the tutorial: Quartus Introduction (you must at least do the version that uses Verilog, and can consider also doing the Schematic design version). Download tutorials from https://www.altera.com/support/training/university/materials-tutorials.html; perform tutorial steps outside of the lab using simulation only
Sept 24	Introduction to Field Programmable Gate Arrays (FPGAs), lookup tables; Introduction to CAD tools Introduction to cost of a logic circuit; terminology: implicant, prime implicant (PI), essential PI, cover, minimum-cost cover; introduction to K-maps (2, 3, 4 variables) More examples of K-maps use, including as a guide to algebraic manipulation	B.6.5, 2.9 2.11 – 2.14	 Lab 2: Multiplexers, Hierarchy, and HEX Displays
Oct 1	5-variable K-maps; don't cares, examples, including 7-seg with don't cares Storage elements: introduction, RS latches, timing diagrams, gated RS latch. Gated D latch, D flip-flops, Flip-flop reset/preset, setup and hold times	2.8.3 5.1 - 5.4, 5.7	 Lab 3: The case statement, Adders, and ALUs
Oct 8	Verilog latches in if-else, case statements Registers, shift registers, Verilog for registers, blocking vs non-blocking FFs in FPGAs	A.11.1 – A.11.4 5.8, 5.12, 5.13, A.11.7	**Thanksgiving Monday Oct. 8, 2018** **Midterm: Thursday Oct. 11, 2018, 6-8pm** **NO LAB THIS WEEK**
Oct 15	T FF Counters; ripple and synchronous counters; Verilog for counters, enable inputs Timing, skew	5.5 5.9, 5.10, 5.13 5.15	Lab 4: Latches, Flip-flops, and Registers
Oct 22	Finite state machines intro FSM state assignment, binary encoding, one-hot, Verilog code for FSMs	6.1 6.2, 6.4, 6.5	Lab 5: Clocks and Counters
Oct 29	FSM timing issues (Moore vs Mealy models) RAM and ROM, including FPGA embedded memory Discussion of course project, incl VGA and videos	6.3 B.9	 Lab 6: Finite State Machines
Nov 5	Signed numbers; 2's complement; adders/subtractors, arithmetic overflow Carry lookahead adders, multipliers	3.3 3.4, 3.6	Lab 7: Memory and VGA Display
Nov 12	Arithmetic coding with Verilog Combinational circuits: implementing logic functions using only multiplexers, Shannon's Expansion Logic Synthesis using LUTs	3.5 4.1 B.6.5	 Project 1
Nov 19	Decoders, other combinational circuits; Verilog code FSM State Minimization Design example: Introduction to processors	4.2 – 4.6 6.6 7.1 – 7.2	Project 2
Nov 26	More simple processor Transistors and gates, structure Passing 1's and 0's, transmission gates, fan-in	 B.1 – B.3, B.8.1 B.8.7 – B.8.9	Project 3
Dec 3	Clock skew, clock synchronization, switch debouncing	7.8	

Informal tutorials will be held commencing Tuesday Sept. 11, 6-7pm, room is MY306, except October 16 in GB244.