1. ECEC 661, Digital Systems Design, ece.drexel.edu/courses/ECE-C661

2. Credits: 3.00 Contact Hours: 3-hours/week Lectures

3. Instructor: Prawat Nagvajara, Ph.D. (Associate Professor)

4. Textbook and Materials
Recommended References:

5. Specific Course Information
   a. Brief description of the course (Course Catalog Description) A project-based course on design concepts, tools and implementation of systems with embedded processors, library IP (Intellectual Property) cores and custom IP cores, synthesis and Field Programmable Gate Array (FPGA) implementation.
   b. Pre-requisites or Co-requisites: Strong experience in Hardware Description Language (HDL) and Electronic Design Automation (EDA) tools comparable to an undergraduate digital design with HDL/EDA such as ECE-C302.
   c. Selected elective in MS in Computer Engineering and MS in Electrical Engineering programs.

6. Specific Goals for the Course
   a. Course Outcomes:
      1. Understanding of digital design and implementation – synchronous systems, state machines, processor-peripheral bus and memory.
      2. Strong experience of specification and verification (debug and testing) by having the design-under-test being a peripheral of a processor. Test application and observation is done by a program accessing the design-under-test ports via a bus.
      3. Strong experience of design with Hardware Description Language (HDL), simulation, and synthesis of hardware from HDL on programmable electronics (Field Programmable Gate Array, FPGA).
      4. Strong design experience on specification, design, implementation and verification using projects such as building a reduced instruction set processor.
   b. Students Outcomes
      (a) an ability to apply knowledge of mathematics, science, and engineering
      (b) an ability to design and conduct experiments, as well as to analyze and interpret data
      (e) an ability to identify, formulate, and solve engineering problems
      (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
7. Brief List of Topics to be Covered
   1. Embedded design; processor platform, peripherals custom cores, bus interfaces, memory and DMA (Direct Memory Access)
   2. Array processing (e.g., pipeline processing)
   3. Behavioral description project on stack processor design and implementation
   4. IP (Intellectual Property) Cores generation, simulation and implementation
   5. Arithmetic hardware; fixed-point, floating-point and CORDIC (Coordinate Digital Computing)
   6. Special-purpose hardware, filters and linear algebra. Plausible projects on filters or matrix computation.
   7. Electronic design automation tools and Integrated Design Environment: Compiler, simulation, synthesis and implementation on Field Programmable Gate Array (FPGA).

8. Evaluation
   a. Design Assignments 30%
      Students demonstrate the design correctness and their understanding
   b. In-lab design midterm exam 25%
      i. Students demonstrate the design correctness and their understanding. Students earn partial credits on incomplete designs.
      ii. The midterm exam is during the week 6
   c. In-lab design final exam 45%
      Students demonstrate the design correctness and their understanding. Students earn partial credits on incomplete designs.
   d. Grades assignment A is scores > 90%, B is 75% < scores < 90%, C is 60% < scores < 75% and D is 50% < scores < 60% and F is scores < 50%

9. Academic Policies
   b. Students with Disabilities: Refer to http://drexel.edu/oed/disabilityResources/faculty/SyllabusStatement/
   c. Course Drop Policy: Refer to http://www.drexel.edu/provost/policies/course_drop.asp