**ECE 477 Advanced Digital VLSI System Design with VHDL + Lab**

*Cankaya University, ECE Department*

|  |  |
| --- | --- |
| Term: | Spring 2015 |
| Weekly Hours: | 3 hours lecture + 2 hours lab. |
| Website: | ece477.cankaya.edu.tr |
| Instructor: | Dr. Emre Yengel |
| Room: | L1-06 |
| Phone: | 0312 233 1309 |
| Email: | e.yengel@cankaya.edu.tr |

 **Course Description:**

Introduces the design of complex digital systems using hardware description languages. Teaches design methodologies which partition a system into a data path and controller. Focuses on synthesizable RTL VHDL code for digital circuit design using dataflow, structural, and behavioral coding styles. Introduces VHDL simulation and verification, and FPGA synthesis, placement, routing, timing analysis and performance optimization. Requires semester-long project devoted to the design of a complex digital system implemented on FPGAs.

**Tentative Course Content:**

1. Design of Digital Hardware
2. VHDL Basics
3. UART
4. Concepts of Implementation with SPLD, CPLD, FPGA
5. Circuits synthesized from VHDL code
6. Number Representation and arithmetic circuits
7. VHDL for combinational circuits
8. VHDL for sequential circuits
9. Finite State Machines
10. Register Transfer Methodology (RTL)
11. Testing of Logic circuits
12. Implementation circuits with CPLD and FPGA

**Tentative Lab Content:**

1. Compiling VHDL Codes and Programming FPGA
2. Clocked Circuit Design and Simulation
3. Usage of Buttons, Switches and Seven-Segments on FPGA Board
4. Programming External 16-Button Keypad on FPGA
5. Using an External Two Axis Joystick on FPGA Card
6. Rotary Encoder PMOD Programming
7. VGA Programming on FPGA
8. External Mouse/Keyboard Connection to FPGA
9. Controlling Mouse/Keypad and VGA Simultaneously on FPGA
10. Voice Processing on FPGA by Using External Microphone
11. Programming External 3-Axis Accelerometer
12. Programming External GPS Receiver

**Grading Policy:**
Home works : %10
Lab : %30
Attendance : %5
Midterm : %25
Final : %30

**Recommended Text Books:**

* Fundamentals of Digital Logic with VHDL Design (3rd ed.), S. Brown, Z. Vranesic (2008), ISBN: 978-0077221430
* FPGA Prototyping by VHDL Examples, Xilinx Spartan-3 version, Pong P. Chu (2008), ISBN: 978-0470185315
* VHDL for Logic Synthesis, Andrew Rushton (2011), ISBN: 978-0470688472