Instructor: Rahul Dubey [Extn: 645]

Learning Objectives: Hardware Description Language (HDL) based digital design process and rapid prototyping tools like Field Programmable Gate Arrays (FPGA) are becoming ubiquitous components in the design of complex digital systems. Their applications are far reaching – they are used in the design of processors, filters, networking systems. This course will use Verilog HDL for designing HDL based digital systems on FPGAs.

Topics:

1. Introduction to digital design methodology
2. Introduction to logic design with Verilog
3. Fundamentals of sequential logic design – Mealy, Moore machines
4. Behavioral modeling of combinational and sequential logic
5. Synthesis of combinational and sequential logic
6. Design and synthesis of Datapath Controllers
7. Arithmetic processing – Multiplication, Division of signed/unsigned integers and fractions
8. Pipelining
9. Overview of different Programmable Logic Device (PLD) platforms
   a. Technologies for PLD – SRAM, Flash, Anti-fuse
   b. Simulation of hardware control scheme in Matlab Simulink environment.
   c. Components of typical PLD, Embedded memory, PLL, Hardware multiplier
   d. Functional simulation of design using on-chip resources; Use of vendor provided canned functionality. Example – Xilinx Coregen
10. Design of Processors, Filters and networks using HDL
11. Communication protocol handling – UART, LIN, CAN, Modbus using HDL

Laboratory experiments using HDL and FPGA

a. Revision of Verilog experiments, PLD based embedded soft processor cores
b. Interfacing to external world – ADC, DACs, Memories, Display devices, Sensors, Actuators
   c. Robot design using FPGA
   d. On-chip verification using PLD software
   e. Filter implementation

Course evaluation: 20% In-sem Exam, 20% lab, 20% HDL project, 40% Final Exam

Reference Books and Datasheets (In alphabetical order)

1. Cilleti – Advanced digital design using Verilog HDL
2. Palnitkar – Digital Design using Verilog HDL
3. Vendor Data sheets and application notes

(Some more reference books may be identified as the course progresses)