`

CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING
A-34, PHASE VIII, INDUSTRIAL AREA, MOHALI
TELEPHONE NO: 0172-2237052, 53, 54, 55 FAX: 0172-2237050
EMAIL: enquiry-mohali@cdac.in, website: www.cdac.in

SYLLABUS FOR SIX MONTHS TRAINING OF ADVANCED VLSI DESIGN AND NANO-ELECTRONICS

This course is divided into two modules i.e. Advanced VLSI and Nano-electronics. The Module-I i.e. Advanced VLSI Designsdesigned to provide students with sufficient hands on experience with VLSI design tools and to provide industry exposure for future career selection in VLSI industry. As The Technology is shrinking from Micro to Nano Scales, so Nano electronics is one of the Major areas of Interest in nanotechnology. The main target is to reduce the size, risk factor and surface areas of the materials and molecules. The Module-II of the course will provide the advanced understanding of nano with respect to electronics in quantum devices, nano tubes and hands on experience of simulation tools. This total course offers 26 weeks of theory with practicals and hands on industry standard EDA tools.

Detailed Syllabus:

Module -I

I. Advanced Digital Design **(2 weeks)**

- Combinatorial Logic Design
- Sequential Logic Design
- State Machines
- Advanced Design Issues: Metastability, Noise Margins, Power, Fan-out, TimingConsiderations

II. VHDL **(2 weeks)**

- Introduction to HDL
- VHDL Flow
- Language Constructs
- Concurrent Constructs
- Sequential Constructs
- Subprogram
- Packaging

`

- Timing Issues
- The Concept of Simulation and Synthesis
- State Machine Synthesis
- Efficient Coding Styles

III. Verilog HDL (3weeks)

- Data Types
- Modeling Concepts
- Task and Functions
- Specify Block and Timing Checks
- Verification and Writing Test Benches

IV. FPGA Architecture (1 week)

- Architecture study of some popular FPGA families
- Detailed study of a Xilinx FPGA family (Virtex-5)

V. ASIC Design (1 week)

- ASIC Design Flow
- Different Technology Options
- Power Calculations
- Clock Methodologies
- Design Flow (Design Specification, Verification Plan, RTL Description,
- Functional Verification, Synthesis)

VI. SPICE Simulation Modeling

VII. CMOS VLSI Design (2 week)

- Introduction to the MOS Technology and Fabrication Process Flow
- Design of Basic Gates using CMOS, transmission gates etc
- Design of complex logic
- Device sizing, timing parameters & estimation of layout resistance & capacitance
- Introduction to low power VLSI design and design techniques
- Design rules for CMOS layout
- Introduction to layout and simulation tools
- Place and Route Extraction, LVS
- Netlist to GDS-II flow
- Device Generator Libraries

`

MODULE- II

I. **Introduction** **(2 weeks)**

- Fundamentals of nanotechnology and nanoelectronics
- Moore's Law and Its Significance
- Size Dependent Electrical Properties in Nanomaterials
- Development of Nanoelectronics; Some Tools of Micro and Nanofabrication
- Semiconductor Quantum Dots, Metal nanoparticles,
- CNT and its functionalization

II. **Quantum Electronicsand Bio-NanoElectronics** **(4 weeks)**

- Excitons, band-gap variations-quantum confinement,
- High Electron Mobility Transistors; Single Electron Transistors; Carbon Nanotube Transistors;
- Quantum Computers: Working of Quantum Computer, Difference Between Quantum and Classical Computer, Decoherence,
- Self-Assembled Monolayers
- 3D Optical Memory
- Basic Concepts on Molecular Machines and Nanoscale Motors, Nanovalves
- Structure is Information-DNA: Smart Glue, Wire Template
- A Biological Nanotechnology Future.
- Nano Polymer, Characteristics of Neural Networks in Nanoelectronics

III. Photonics and Solar Energy **(4 weeks)**

- Photonic crystals
- Interaction of Light and Nanotechnology: Photon Trapping and Plasmons,
- Dielectric Constant and Polarization
- Nanoholes and Photons, Imaging, Energy Efficient Windows
- Solar Absorbers Based on Nanoparticles.

IV. Major project using simulation tools. (Remaining days)