

# The Secrets of Electronics in two Days

## Course Description

This course presents the essentials of Electronics engineering and Hardware Design for software engineers. The course is a complete tour of the fundamentals of electrical engineering. It will enable the software engineer that works with an electronics engineer's better communicate and understand the electrical engineering when working on a common project. The course presents examples of all the learning material.

**Training Duration:** 2 days

**Level:** Fundamental

## Who Should Attend?

- Software engineers that want to gain broad knowledge and principles of electronic engineering
- Software engineers that participate in projects along with electronic engineers
- Manager and project managers that have to better understand the projects they manage
- Purchasing managers that want to be acquainted with the products they buy

## Prerequisites:

None

## Course Outline

### 1. Introduction to electronics

- Electronic product
- Development of electronic product
- Future Trends

### 2. Basic concepts and principle in electricity and electronics

- Atoms, Protons, Electrons
  - Voltage, Current, Resistors, Conductance, Power, Batteries, Solar cells, Capacitors, Inductors, Diodes, Transistors
  - Prefixes & Units (Ampere, Watt, Waves, Hertz) & Basic schematic symbols
- Magnetism
- Ohm's Law
- AC, DC, Static electricity
- Measuring devices

### 3. Digital Hardware

- Logic signals
  - Logic gates (NOT, AND, OR, NAND, NOR, XOR, XNOR)
- Truth table
- Boolean algebra
- Karnaugh map
  - Flip-flop, Counter, Register, Encoders and Decoders

### 4. Introduction to semiconductors

- The semiconductor revolution
  - Semiconductor materials (Wafer Types such as: Silicon, GaAs, and Si-Germanium)
  - Diodes, BI-Polar transistor (PNP, NPN), JFET, Amplifiers, Oscillators
- The IC technology
- PAL, CPLD, FPGA, ASIC, Structured ASICs
- HDL - Hardware Description Languages (VHDL, Verilog, System Verilog, SystemC)
  - Product design at the Electronic System Level (ESL) in the System-on-a-Chip (SoC)
  - ASIC and FPGA Design Flow (Design, Functional/Behavioral Simulation, Design Synthesis, Design Implementation (Optimization, Mapping, Placement, Routing, Bitstream Generation), Static Timing Analysis, Back Annotation, Timing Simulation, In-Circuit Verification).
- IP Core, NRE, Open Source
- EDA Tools (Simulation, Synthesis, Verification, ChipScope, Place & Route)
  - ASIC and FPGA manufacturers (foundries)
  - FPGA to ASIC Conversion and vice versa

### 5. Concept of computers hardware and software

- Computer Architecture
  - CPU Structure (CISC, RISC), Motherboard, Microprocessor and Microcontrollers
- Data transfer
  - Memory and Data Storage (Hard drive, ROM, PROM, EPROM, EEPROM, RAM, DRAM, SRAM, SDRAM, FLASH, CDROM, DVD)
  - Computer bus – Address bus, Data bus, Control bus
- DMA, USB, BIOS

### 6. Analog & Digital electronics

- Analog signal
- ADC, A/D - analog-to-digital converter
- DAC, D/A - digital-to-analog converter
- Modem Modulation (PSK, FSK, AFSK, MSK, GMSK, ASK, OOK, QAM, CPM, MSK and GMSK)
- DSP - digital signal processing

### 7. Devices packing

- SMD, FPT, BGA, TSOP, QFP, PLCC, SOIC, SOJ

### 8. Reading a Schematic

- Schematic symbols

### 9. Summary