EMBEDDED SYSTEMS

Post-Graduate Certificate Program

UC SANTA CRUZ SILICON VALLEY CAMPUS
UCSC Silicon Valley Extension

in partnership with Higher Education

Embedded systems refer to a growing range of function-specific computer and communication systems, including mobile devices, Internet of Things, networking equipment, industrial controllers and military electronics. UCSC Silicon Valley Extension's certificate program offers a comprehensive curriculum in Embedded Systems that will help new engineers gain experience in the field, and benefit practitioners who want to keep up with the changing technology.

Who Should Attend?

- Anyone wanting to enter the burgeoning field of embedded systems
- Hardware designers who want to gain overview or specific in-depth knowledge in certain areas
- Programmers who want to learn the architecture and programming of embedded systems
- Anyone already working in the field who wants to keep up with this rapidly changing industry

Prerequisites

Technical aptitude, a background in science and technology, engineering degree, programming experience, or equivalent knowledge acquired through training and experience in the field.

Curriculum

Certificate | 2 Quarters | 15 Units

C Programming for Beginners | 3 Units
This course is for individuals who want to learn C programming language but have little or no programming background. The course begins with an overview of programming and tools. It introduces functions, data types, input/output, strings, operators, precedence, and expressions. It also demonstrates the use of control statements, arrays, and pointers for problem solving. You will receive assignments to write non-trivial programs and learn to create modular programs with efficiency and readability.

C Programming, Advanced | 3 Units
This course will broaden your skills as a C language programmer by introducing sophisticated problemsolving techniques, including the advanced use of pointers, abstract data types, data structure concepts and optimization techniques. The course covers the design, implementation, and use of advanced data structures, based on primitive data types. Emphasis will be on programming that employs and improves upon a variety of data structures. You will learn to write efficient programs by understanding the complexities of various algorithms.

Digital Logic Design Using Verilog | 3 Units
The course starts with the basic concepts of hardware description, then goes into the key Verilog language elements and data types. Students tackle key challenges and learn structural, dataflow and behavioral modeling in Verilog, including common constructs, considerations and coding examples. Instruction in the coding and testing of digital logic includes examples of combinational circuits, sequential circuits , and complex logic.

Embedded Systems Hardware Architecture, Introduction | 1.5 Units
This course covers the hardware components and interfaces in a typical embedded system, beginning with an inside look at some typical embedded systems and the functional blocks within those systems. The course addresses design considerations for such systems and several approaches to system building. You'll also learn about the various types of memory commonly used in embedded systems, basic concepts in microprocessors, microcontrollers and DSP, and the typical buses used at the system level.

Practical Design with Xilinx FPGAs | 3 Units
This course delves into details on using FPGA resources, managing constraints and debugging methods for real-world designs. You'll discuss embedded design combining soft processors with fabric, as well as high performance, low-power design and multiple clock domain techniques. Complete a hands-on design project using the Xilinx FPGA Board Starter Kit.

System Design for Low Power Management | 1 Unit
This course takes a practical learning approach to designing low-power systems with the ultimate goal of attaining zero power (defined by the international standard IEC 62301 as less than 5mW). The course covers key design techniques covering the different modes of system operation, power optimization of different system blocks, design with energy harvesting, and power management of power conversion stages. Lectures will be supplemented with hardware demonstrations and waveform observations of power management implementations in power conversion stages.

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Additional Curriculum

Certificate & OPT | 3 Quarters | 29 Units

Embedded Firmware Essentials | 2 Units
This course provides practical knowledge and coding xercises in firmware development, beginning with the ARM Cortex-M RISC instruction set and pipelines. You will be introduced to the system memory hierarchy: cache, DDR3, and flash memory. The course includes common firmware topics and techniques such as GPIOs, RS232, I2C, circular buffers, and debugging with JTAG, SWD and GDB. You will learn to mix programming languages in firmware development and the power-on sequence. A board project provides hands-on experience.

The Internet of Things: Communication and Cloud | 3 Units
The course reviews the fundamentals of an IoT system, including devices, mobile phones, cloud and communications. You will be introduced to the features and programming of an Arduino development board, based on an 8-bit RISC microcontroller. The course covers the latest technology trends in Internet and cloud communication protocols and interactions. Each of the major communication technologies for IoT devices (Wi-Fi and Bluetooth/BLE) will be discussed with lab project assignments.

Real-time Embedded Systems Programming, Introduction | 3 Units
This hands-on introductory course provides a foundation in real-time embedded systems. The course begins with the fundamentals of real-time scheduling and resource management protocols. It reviews embedded system hardware, including system interfaces, real-time programming techniques and architectures. The course covers the use of RTOS to meet real-time requirements. You will learn important concepts, including interrupt handling, polling, using timers, and detecting and preventing deadlocks. There will also be discussions of multi-threading, cooperative vs. preemptive multitasking and inter-process communications.

Embedded Design with Xilinx FPGAs | 3 Units
This hands-on course will introduce you to the world of embedded microprocessor design using field programmable gate arrays (FPGAs). Combining the FPGA fabric with the popular ARM 9 processor cores, it opens up many possible applications with integrated custom peripherals and significant cost/time advantages in design.

Linux, Introduction | 2.5 Units
Linux is gaining popularity on personal computers, devices, embedded systems and enterprise servers. The course gives students an opportunity to use Linux for personal or professional purposes. Learn basic Linux administration, Linux file and directory structure, basic network configuration, shell programming and various utilities.

Internships (unpaid) | 3 Units
Minimum 90 Hours Per Quarter
Enrolling in a certificate program allows you to participate in multiple unpaid internships at local companies in your field of study. Internships are available across a variety of sectors, generally at mid-sized companies, such as Agylytyx, Crowdera Inc, Innowest, and YMedia Labs. Good internships are much sought after and highly competitive. To stand the best chance of securing your preferred placement, our Internship Coordinators are on hand with expert support and guidance.

Courses in the certificate programs are subject to change based on schedule availability and/or student aptitude. Equivalent course substitutions will be made to accommodate.