WINTER 2012

UCSC Silicon Valley Extension

2505 AUGUSTINE DRIVE, SUITE 100, SANTA CLARA, CA 95054

Engineering and Technology

ucsc-extension.edu/engineering

Engineering and Technology

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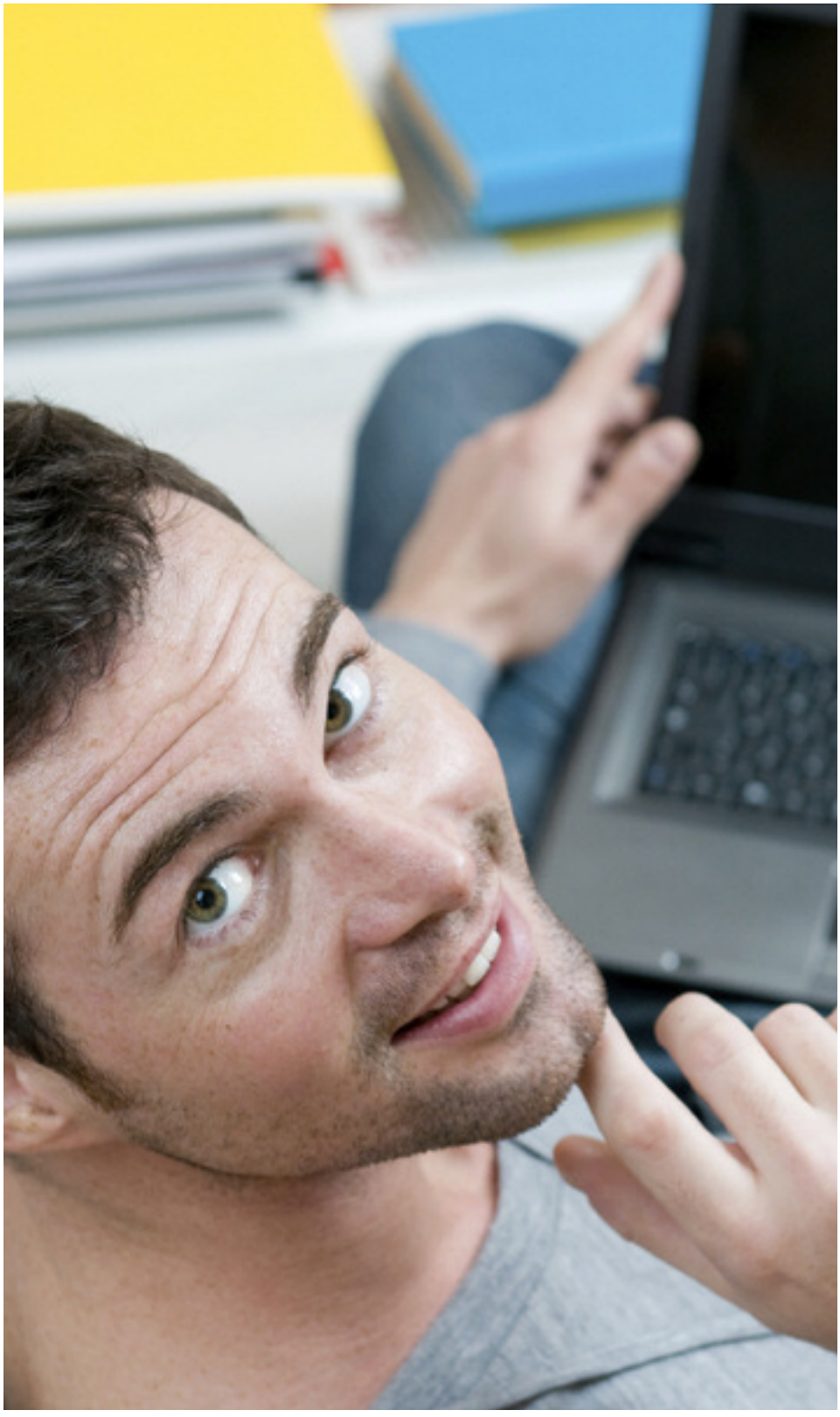

Free Program Overview

Embedded Systems, VLSI, and Network Engineering

This free event covers three certificate programs. The VLSI Engineering Certificate Program is for professionals working in the integrated circuit, ASIC, semiconductor, EDA, device and system industries in Silicon Valley. The Embedded Systems Certificate Program is for professionals working in the hardware and system design fields, with courses in system design, embedded programming, real-time systems, and DSP/DV. The Network Engineering and Systems Security Certificate Program provides fundamental and advanced networking and security topics that are relevant to the networking and IT industries. Presenters at the program overview will discuss new developments in each field. You'll learn how these courses can help you break into new fields, and advance your career.

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SANTA CLARA CLASSROOM
Tuesday, 6–8:30 pm, January 10.
No fee, but enrollment required
To enroll, use Section Number 20544.(010)

Hardware Systems and VLSI Engineering

Hardware design engineers throughout Silicon Valley make UCSC Extension their source for training in VLSI design, hardware systems engineering, analog and digital circuit design, microprocessors, PLC, instrumentation, solid-state electronics, nanotechnology, EMC, signal processing, power electronics, communications, control systems, and I/O processing. With a combination of online and traditional courses taught during weeknights and weekends, our convenient courses are ideal for busy Bay Area engineers.

Certificate Program

Embedded Systems

Today's embedded systems development includes microprocessor-based control systems, systems-on-chip (SoC) design, and device software development. Implementations can be found in PDAs, consumer electronics, networking equipment, industrial controllers and military electronics. This program looks at embedded systems engineering as a synergistic integration of hardware and software device design and development. You'll master the essential concepts of embedded systems development by learning algorithms, hardware design, software development, manufacturing and testing.

CERTIFICATE CONTACT

Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW

This program will equip you with essential tools, techniques and an overall understanding of embedded systems. For working professionals in the field of embedded systems, we offer courses in the areas of hardware design (system architecture, board design and interfaces), software development (real time embedded programming, Linux based systems), digital signal processing (DSP and DV) and applications (consumer electronics, networking, and control systems).

Embedded systems are everywhere today. There are vast career and business opportunities related to such systems in Silicon Valley and internationally. Few academic schools provide practical training to students entering the embedded systems field. To meet that need, UCSC Extension Silicon Valley has developed this unique certificate program to help working professionals learn all aspects of embedded systems.

From hardware to software, from algorithm development to practical implementation, we have been training engineers in this burgeoning field for the past 15 years. This is one of the most popular programs within the Engineering and Technology department at UCSC Extension.

PROGRAM BENEFITS

- Certificate program provides the basic knowledge for designing and programming embedded systems
- Wide variety of advanced topics helps students develop areas of specialization
- Courses taught by working professionals
- Board and programming projects for hands-on learning
- Courses frequently updated to reflect changing technology and industry needs

CERTIFICATE REQUIREMENTS

To obtain the Certificate in Embedded Systems, you must successfully complete a total of **14 units**, including one of the three core courses. Each core course is focused on one of three major specialties: Hardware Design, Embedded Software, and Digital Signal Processing and Digital Video. Since the embedded field is diverse, only one core course is required in the area of the student's interest or specialization.

PREREQUISITES

Technical aptitude, a background in science and technology, an engineering degree, programming experience, or equivalent knowledge acquired through training and experience in the field. Prospective students are advised to review prerequisites that apply to individual courses.

EMBEDDED SYSTEMS CERTIFICATE

14-unit minimum

*Choose one of these three core courses	Units	Course	F	W	Sp	Su
System Design						
*Embedded Systems Hardware Architectures, Introduction	1.5	21319	■		■	
IO Concepts and Protocols: PCI Express, Ethernet, and Fibre Channel	3.0	22177	■		■	
Printed Circuit Board Design for Signal Integrity and EMC Compliance	1.5	21943	■		■	
Jitter Essentials	1.5	21321		■		■
Comprehensive Signal and Power Integrity for High-Speed Digital Systems	3.0	22874		■		■
Design Overview of High Efficiency Switch-mode Power Supply	3.0	23590		■		■
Data Acquisition System Design and Implementation	3.0	22873	■		■	
Designing Xilinx CPLDs and FPGAs, Introduction	3.0	6346	■		■	
Designing with Xilinx FPGAs, Comprehensive	3.0	22179		■		■
SystemVerilog for ASIC and FPGA Design	3.0	20095	■		■	
Introduction to System C	1.5	19957	■		■	
Embedded Linux						
*Embedded Linux Design and Programming, Introduction	3.0	3364	■	■	■	
Linux Device Drivers	3.0	2470	❒	❒	❒	❒
Linux Device Drivers, Advanced	3.0	1016	■	■	■	■
Real-Time Systems						
Real-Time Embedded Systems Programming, Introduction	3.0	5381		■		■
Real-Time Embedded Systems Programming: External Input/Output Systems	3.0	3522	■		■	
Embedded Software						
Wireless Technologies for Embedded Systems: Bluetooth, WiFi and ZigBee	3.0	23093	■		■	
Embedded Boot Loaders: BIOS and UEFI	3.0	23092		■		■
USB Device Interface: Architecture, Protocols and Programming	3.0	2179		■		■
Software Testing: Techniques, Tools and Practices	3.0	20501		■		■
Developing Applications for iPhone, iPad and iPod Touch, Introduction	3.0	21938	■	■	■	■
Developing Applications for Android Mobile Devices	3.0	21956	■	■	■	■
Multicore Programming	2.0	22180	■		■	
C Programming for Beginners	3.0	5208	❒	❒	❒	❒
DSP and DV						
*Digital Signal Processing, Fundamentals	2.0	5758	■		■	
DSP Applications in Audio, Imaging, and Communications Systems	3.0	0516		■		■
Coding Theory and Applications, Introduction	3.0	23389		■	■	
Digital Video Compression and Codec	3.0	19025		■		■
Emerging Technologies						
Clean Technology: Smart Grid, Energy Storage, and Green Building	3.0	22749	■		■	
Smart Grid, Introduction	1.0	22867		■		■

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

RECOMMENDED COURSE SEQUENCE
For beginners, take the core courses first. After which, courses may be taken in any order provided the prerequisites are met.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

Courses

C Programming for Beginners

For course description, see page 12.

Coding Theory and Applications, Introduction

For course description, see page 10.

Comprehensive Signal and Power Integrity for High-Speed Digital Systems

X400.121 EE (3.0 quarter units)

This course covers signal and power integrity analysis of high-speed digital systems, and the modeling and design techniques used in high-speed links (in board, package, and connector). The instructor introduces IO modeling including IBIS, behavioral, functional, and ESD. Also explained are signaling techniques such as differential, NRZ, pulse, and multi-level, as well as simulation methods. Students will learn the fundamental concepts in equalization design. At the system level, topics include clocking schemes such as PLL, DLL and CDR; timing jitter analysis; and power analysis topics such as IR drop, AC noise, simultaneous switching noise and decoupling capacitor.

Prerequisite(s): "Printed Circuit Board Design for Signal Integrity and EMC Compliance," and "Jitter Essentials" or equivalent knowledge. Students must have basic understanding of signal integrity, electromagnetic compatibility, and experience with printed circuit boards or packages for high-speed systems.

WENDEM BEYENE, Ph.D.

SANTA CLARA CLASSROOM
10 meetings: Fridays, 6:30–9:30 pm,
January 27–April 6.
Fee: $1020 ($918 through Jan. 13).
To enroll, use Section Number 22874.(004)

DSP Applications in Audio, Imaging, and Communications Systems

X444.4 CMPE (3.0 quarter units)

This course introduces students to the basics of audio-speech, image processing and digital communication systems. The scope of the course encompasses theory, algorithms and practical techniques used in these three popular DSP applications. Through class assignments, you will learn how to program in C/C++, Assembly, or MATLAB using standard DSP libraries. Building on DSP fundamentals, this course presents DSP tools and application examples to give you a broad understanding of the latest DSP techniques in these three popular fields.

Prerequisite(s): "Digital Signal Processing, Fundamentals" or equivalent experience. Programming experience in C/C++ languages, Intel X86 assembly language or Matlab.

DANHUA ZHAO, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Thursdays, 6:30–9:30 pm,
January 19–March 22.
Fee: $910 ($819 through Jan. 5).
To enroll, use Section Number 0516.(015)

✓NEW

Design Overview of High Efficiency Switch-mode Power Supply

Formerly "High Efficiency Switch-mode Power Supply Design Overview"

X400.138 EE (3.0 quarter units) (3.2 CEU)

In this course, you'll gain hands on experience designing high efficiency switch-mode power supplies that can meet current Energy Star and 80 PLUS efficiency standards. The course also covers Europe's upcoming mandatory ErP Directive for no-load and standby power requirements. The lectures will be supplemented with hardware demonstrations and waveform observations of power supply behaviors. The course will equip you with the modern integrated solutions needed to achieve high efficiency and high power density, and includes an introduction to digitally controlled power supplies.

Prerequisite(s): Knowledge of electronics and basic understanding of an electrical system design with power supply.

EDWARD ONG.
JOSELITO PARAYNO.

SANTA CLARA CLASSROOM
8 meetings: Saturdays, 9 am–1 pm,
January 28–March 24.
Fee: $980 ($882 through Jan. 14)
To enroll, use Section Number 23590.(001)

Designing with Xilinx FPGAs, Comprehensive

X400.411 CMPE (3.0 quarter units)

This course delves into details on using FPGA resources, managing constraints and debugging methods for real world designs. Embedded design combining soft processors with fabric are discussed at length, followed by high performance, low-power design and multiple clock domain techniques. Identifying bottlenecks and hot-spots are discussed along with the trade-offs of fabric versus code-based solutions. Advanced debugging techniques are also covered. In-class demonstrations occur weekly, and students must complete a hands-on design project using the Xilinx Spartan 3A or 3AN Starter Kit.

Prerequisite(s): "Introduction to Designing with Xilinx CPLDs and FPGAs" or equivalent experience. Understanding of digital logic design is required. Some knowledge of Verilog or VHDL will be helpful.

JESSE JENKINS, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Wednesdays, 6:30–9:30 pm,
January 25–March 28.
Fee: $980 ($882 through Jan. 11).
To enroll, use Section Number 22179.(006)

Developing Applications for Android Mobile Devices

For course description, see page 14.

Developing Applications for iPhone, iPad and iPod Touch, Introduction

For course description, see page 14.

Digital Video Compression and Codec

X400.296 CMPE (3.0 quarter units)

This introductory course covers the fundamentals of digital video and audio, compression techniques including H.264/MPEG-4, and the basics of video encoder/decoder design. Topics include the development of functional design as well as the input/output requirements for an encoder in your application domain. Using the MPEG-4/H.264/AVC encoder, you will learn how to choose the architecture and functional structure of the codec, and then go on to design encoder profiles. Applications to be discussed include mobile video, streaming video, video storage, video broadcast and video conferencing.

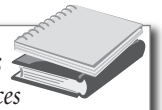
Prerequisite(s): College level calculus and a basic understanding of imaging and video device related applications.

KRISHNA VALLABHANENI, M.S.

SANTA CLARA CLASSROOM
10 meetings: Mondays, 6:30–9:30 pm,
January 23–April 2 (no meeting Feb. 20).
Fee: $910 ($819 through Jan. 9).
To enroll, use Section Number 19025.(010)

ACCESS TO ONLINE RESOURCES

WEB COMPONENT indicates that classroom instruction is supplemented with online materials or activities. Students enrolling in one of these courses for the first time will receive an e-mail with logon information within 24 hours. However, access to course resources may not be active until one day prior to the course's start date.



Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

Embedded Boot Loaders: BIOS and UEFI

X400.438 CMPE (3.0 quarter units)

In this course, you'll learn about BIOS (Basic Input/Output System) and UEFI (Unified Extensible Firmware Interface). The course starts with BIOS history and architecture. Students learn BIOS device enumeration and configuration. The course covers BIOS interfaces including software interrupts, option ROM interface, and boot mechanism. Following an overview of UEFI history, architecture and services, you'll learn the UEFI driver architecture and how to write UEFI drivers and applications. The course concludes with UEFI debugging methodologies and briefly addresses U-BOOT. This course includes some hands-on programming.

Prerequisite(s): "Embedded System Hardware Architectures, Introduction" or equivalent experience, and a good working knowledge of X86 Assembly and C Language.

NATARAJAN SIVAGAR, B.E.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Thursdays, 6:30–9:30 pm,
February 2–April 5.
Fee: $910 ($819 through Jan 19).
To enroll, use Section Number 23092.(003)

Embedded Linux Design and Programming, Introduction

For course description, see page 8.

Jitter Essentials

X400.085 EE (1.5 quarter units)

Learn the definitions of various types of jitter (including phase noise), understand which type of jitter is important to your application and why, plus learn how to propagate jitter through a system, create jitter budgets, measure and minimize jitter, and more. Emphasis will be placed on developing a working knowledge of jitter, such as establishing a common language, understanding jitter beyond the definitions, gaining insight by making simplifying assumptions, and visualizing relationships between different types of jitter.

GARY GIUST, Ph.D.

SANTA CLARA LAB
2 meetings: Saturdays, 9 am–5 pm, March 10, 17.
Fee: $760 ($684 through Feb. 25).
To enroll, use Section Number 21321.(007)

ADVANCED INFORMATION TECHNOLOGY COURSES

We offer a unique set of courses for IT professionals to learn advanced techniques in managing today's enterprise IT infrastructure and data centers. Practical solutions for real-world problems!

- Designing Networks and Systems for High Availability
- Linux System and Network Administration
- Linux System Performance and Tuning
- Enterprise Application Performance Management (APM) for Java EE and .NET Platforms
- VMware vSphere 4: Configuration and Management

Linux Device Drivers

For course description, see page 8.

Linux Device Drivers, Advanced

For course description, see page 8.

Real-time Embedded Systems Programming, Introduction

X439.7 CMPE (3.0 quarter units)

This introductory course begins with a review of embedded system hardware, including a discussion of system requirements for real-time systems. It follows up with real-time programming techniques and architectures. The course covers the use of real-time operating systems (RTOS) to effectively structure large programs as well as designing device drivers to meet real-time hardware requirements. There will also be discussion of multi-threading, cooperative vs. preemptive multi-tasking and inter-process communications. Students will gain hands-on experience with a programming project on a board.

Prerequisite(s): A strong background in C programming and an understanding of embedded system architecture.

AVNISH AGGARWAL, M.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm,
January 17–March 20.
Fee: $910 ($819 through Jan 3).
To enroll, use Section Number 5381.(027)

Smart Grid, Introduction

X400.118 EE (1.0 quarter unit)

To address shortcomings in the traditional power grid, the smart grid brings together information technology, communications and control technology and power system engineering. This course introduces the building blocks of an end-to-end smart grid system. Topics covered include advanced metering infrastructure, smart meter technology and Home Energy Management Systems. The instructor presents a complete and up-to-date review of smart grid architecture, promising applications, the microgrid and energy storage technologies. Students learn the important standards being developed for smart grid and the smart grid innovation zones.

Prerequisite(s): A background in science or engineering.

VICTOR KOLESNICHENKO, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
4 meetings: Mondays, 6:30–9:30 pm, March 5–26.
Fee: $550 ($495 through Feb. 20).
To enroll, use Section Number 22867.(004)

Software Testing: Techniques, Tools and Practices

For course description, see page 21.

✓REVISED

USB Device Interface—Architecture, Protocols and Programming

X429.1 CMPE (3.0 quarter units)

This course covers USB architecture, protocols and features. Communication, control, and application layer protocols for generic USB devices are covered. You will learn how to pick the optimal USB protocols to meet performance and bandwidth requirements. The course introduces the basic USB programming model, USB libraries and the higher level USB software required to implement specific device functionality. The course emphasizes effective design and test techniques and the use of USB debugging tools. The course focuses on the device side USB interface, and includes a class project based on a PIC USB kit.

Prerequisite(s): Strong C experience is required, including C program memory map, pointers and source level debugging. Students should also understand basic microprocessor and networking concepts such as microprocessor IO ports, DMA, and interrupts.

AVNISH AGGARWAL, M.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Thursdays, 6:30–9:30 pm,
January 26–March 29.
Fee: $980 ($882 through Jan. 12).
To enroll, use Section Number 2179.(012)

Also of Interest

C Programming, Advanced

For course description, see page 12.

Digital Logic Design Using Verilog

For course description, see page 6.

TCP/IP Essentials

For course description, see page 11.

Certificate Program

VLSI Engineering

CERTIFICATE CONTACT
Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW
Design engineers have broad responsibility for hardware specification, analysis, logic design, verification, simulation, synthesis, testing and maintenance of integrated circuit products. While some have advanced degrees in computer science or electrical engineering, few have the practical education required for design, development and maintenance of complex VLSI devices to accommodate cost control, schedule and customer requirements.

The VLSI Engineering certificate program meets this need. Taught by working professionals, this program provides you with the tools, techniques and overall understanding of the VLSI design process needed in the design of small- to large-scale hardware products. You will acquire a comprehensive understanding of the entire design process and how each phase supports the development of a VLSI product. The program also prepares you for design work on VLSI projects at systems or semiconductor companies and provides you with required knowledge in simulation, verification, synthesis and testing using modern EDA tools.

CERTIFICATE REQUIREMENTS
To obtain the Certificate in VLSI Engineering, you must successfully complete a total of **14 units.**

RECOMMENDED COURSE SEQUENCE
It is recommended that you take at least one course from the "Design Methodology" category. Other courses may be taken based on your interests and professional level.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

Courses

Coding Theory and Applications, Introduction

For course description, see page 10.

Comprehensive Signal and Power Integrity for High-Speed Digital Systems

For course description, see page 3.

✓NEW

Developing the Nanometer ASIC: From Spec to Silicon

X402.9 CMPE (1.5 quarter units)

This course covers each step in developing an ASIC, explaining in an intuitive and visual manner such key concepts as transistor action, standard cells, RTL synthesis, meeting timing, functional coverage, formal equivalence, physical design, signal integrity, DFT and BIST, tape-out, IC fabrication, and emerging packaging trends. The course includes hands-on "quick tour" labs to familiarize students with the use of EDA tools. The focus is on mostly-digital ASICs with multiple IP cores, low-power goals, and on-chip RF-CMOS/analog blocks.

Prerequisite(s): General understanding of digital logic.

CHARLES T. DANCAK, M.S.E.E.

SANTA CLARA LAB
5 meetings: Thursdays, 6:30–9:30 pm, January 19–February 16.
Fee: $610 ($549 through Jan. 5).
To enroll, use Section Number 3497.(088)

Free Program Overview

Embedded Systems, VLSI, and Network Engineering

For event description, see page 1.

SANTA CLARA CLASSROOM
Tuesday, 6–8:30 pm, January 10.
No fee, but enrollment required
To enroll, use Section Number 20544.(010)

VLSI ENGINEERING CERTIFICATE

14-unit minimum	Units	Course	F	W	Sp	Su
Design Methodology						
Developing the Nanometer ASIC: From Spec to Silicon	1.5	3497		■		■
Designing Xilinx CPLDs and FPGAs, Introduction	3.0	6346	■		■	
Logic and Functional Design						
Digital Logic Design Using Verilog	3.0	0764		■		■
Logic Synthesis, Introduction	3.0	4377		■		■
Introduction to System C	1.5	19957	■		■	
Practical Logic Design by Example	3.0	22607	■		■	
Practical DFT Concepts for ASICs: With Nanometer Test Enhancements	3.0	5373		■		■
IO Concepts and Protocols: PCI Express, Ethernet, and Fibre Channel	3.0	22177	■		■	
Coding Theory and Applications, Introduction	3.0	23389		■	■	
SystemVerilog and Verification						
Design Simulation with Verilog and System Verilog	3.0	6932	■		■	
SystemVerilog for ASIC and FPGA Design	3.0	20095	■		■	
SystemVerilog Assertions for Design Verification	3.0	20062			■	
SystemVerilog for Advanced Design Verification	3.0	18966		■		■
Structured Verification Using UVM (Universal Verification Methodology)	1.5	0027	■		■	
Physical Design and Timing Closure						
Physical Design Flow from Netlist to GDS II	3.0	4436		■		■
ASIC Physical Design, Advanced	3.0	0634	■		■	
Timing Closure in IC Design	3.0	4775	■		■	
Circuit Design						
Low-Power Design of Nano-Scale Digital Circuits	3.0	21941	❍	❍	❍	❍
Analog IC Design, Introduction	3.0	3799	■			
Mixed-Signal IC Design	3.0	1999		■		■
PLL and Clock/Data Recovery Circuits	3.0	2283	■		■	
Designing CMOS Radio Frequency Integrated Circuits (RFIC)	3.0	22866			■	
Jitter Essentials	1.5	21321		■		■
Comprehensive Signal and Power Integrity for High-Speed Digital Systems	3.0	22874		■		■
Emerging Technologies						
Solar Energy Technologies: A Comprehensive Study	1.5	20814		■		■
Clean Technology: Smart Grid, Energy Storage and Green Building	3.0	22749	■		■	

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Digital Logic Design Using Verilog

X467. CMPE (3.0 quarter units)

This course prepares students to implement Verilog modeling of digital logic. Students learn Verilog constructs and hardware modeling techniques. The course covers Verilog language elements and data types. Students tackle key challenges and learn structural, dataflow and behavioral modeling in Verilog, including common constructs and coding considerations. Instruction in the coding and testing of digital logic includes examples of combinational circuits (gates, mux/demux, encoders/decoders, and Boolean expression), sequential circuits (latches, flip-flops, shift registers, counters, RAMs and ROMs), and complex logic (flavors of ALU and FSM).

Prerequisite(s): Knowledge of basic logic design and familiarity with a high-level programming language (e.g., C) and use of a text editor.

JAGADEESH VASUDEVAMURTHY, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Saturdays, 9 am–12 pm,
January 21–March 31.
Fee: $980 ($882 through Jan. 7).
To enroll, use Section Number 0764.(180)

Jitter Essentials

For course description, see page 4.

Logic Synthesis, Introduction

X402.4 CMPE (3.0 quarter units)

This course outlines various concepts of logic synthesis. Starting with the basics of synthesis, the course explains the Synopsys tools and their use in synthesizing high-level language into gates. It also covers various options such as partitioning, design, gate-level optimization, time/area constraints and library management. This course is intended for design engineers with some knowledge of hardware description languages such as Verilog HDL or VHDL. It is a lab-based course with hands-on exercises.

Prerequisite(s): Some knowledge of a hardware description language (Verilog or VHDL).

PRAVIN BHUSARI, M.S.E.E., B.S.E.E.

SANTA CLARA LAB
10 meetings: Tuesdays, 6:30–9:30 pm,
January 31–April 3.
Fee: $980 ($882 through Jan. 17).
To enroll, use Section Number 4377.(097)

Low-Power Design of Nano-Scale Digital Circuits

X400.097 EE (3.0 quarter units)

This course introduces advanced topics in nano-scale (below 90nm) VLSI device and circuit design. High-performance and low-power design issues in modern and future nano-scale CMOS technologies are discussed in detail. Students will learn low power design approaches and techniques at different levels of abstraction. New design techniques will be introduced to deal with nano circuit designs under excessive leakage and process variations. Several non-classical CMOS devices for circuit design in such technologies will be explored. Prospects of future non-silicon nanotechnologies will be reviewed.

Prerequisite(s): Knowledge of CMOS technology and digital circuit design in CMOS is recommended, but an overview will be provided.

HAMID MAHMOODI, Ph.D.

ONLINE, January 9–April 23.
Fee: $980 ($882 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 21941.(013)

ONLINE, March 5–June 18.
Fee: $980 ($882 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 21941.(014)

Mixed-Signal IC Design

X416.8 CMPE (3.0 quarter units)

This course helps students understand basic analog circuits and systems, and problems encountered when analog circuits share substrate with digital circuits. Students also learn precautionary measures and techniques used to circumvent these problems. Topics include MOS transistors, basic analog building blocks, phase-locked-loop circuits, sample and hold circuits, comparator design, A/D and D/A converters, and layout considerations in mixed-signal circuits. This course is intended for practicing engineers and design managers who want to understand analog circuit and layout techniques in mixed-signal IC design.

KAMRAN IRAVANI, M.S.E.E.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm,
January 31–April 3.
Fee: $1040 ($936 through Jan. 17).
To enroll, use Section Number 1999.(038)

Physical Design Flow from Netlist to GDS-II

Formerly "ASIC Physical Design Using IC Compiler"

X446.7 CMPE (3.0 quarter units)

This course is an introduction to ASIC physical design flow and tools from netlist to GDS-II. The course starts with floor planning and block pin assignment. The instructor then addresses placement and clock-tree synthesis, followed by routing, and post-route optimization. You will learn RC extraction, static timing analysis, and physical verification. Upon completion of this course, you will possess the essential knowledge and hands-on experience with the backend physical design flows, from a synthesized netlist all the way to layout completion for ASIC chip tapeout.

Prerequisite(s): Basic knowledge of backend design flow. Hands-on experience with Linux/Unix will be required for lab exercises.

ARVIND VIDYARTHI, M.S.

SANTA CLARA LAB
10 meetings: Fridays, 6:30–9:30 pm,
February 3–April 13 (no meeting Mar. 30).
Fee: $980 ($882 through Jan. 20).
To enroll, use Section Number 4436.(012)

Practical DFT Concepts for ASICs: With Nanometer Test Enhancements

X443.9 CMPE (3.0 quarter units)

This hands-on course first builds a solid foundation in scan-based design, testing, and pattern generation (ATPG), using Synopsys RTL DRC, DFT Compiler and TetraMAX. It then explores nanometer enhancements and recent trends in testing, including bridging and delay fault models, BIST logic, source-synchronous clocking to overcome I/O bandwidth limitations on the ATE, physical design modifications such as scan-chain reordering, and digital (IEEE 1149.1) and on-chip analog (1149.4) boundary-scan. This course is ideal for IC designers and test engineers wanting to stay current with emerging test trends and tools.

Prerequisite(s): A working knowledge of digital logic design is recommended.

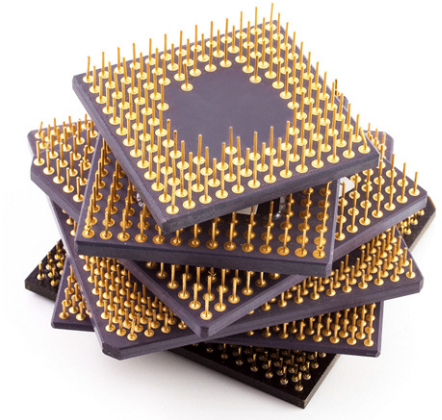
CHARLES T. DANCAK, M.S.E.E.

SANTA CLARA LAB
10 meetings: Wednesdays, 6:30–9:30 pm,
January 25–March 28.
Fee: $980 ($882 through Jan. 11).
To enroll, use Section Number 5373.(017)

LOGIC AND FUNCTIONAL DESIGN COURSES

In addition to teaching languages and tools, we also offer courses in logic and functional design of hardware. This knowledge is applicable in the chip, board, and system industries.

- Digital Logic Design Using Verilog
- Practical Logic Design by Example
- IO Concepts and Protocols: PCI Express, Ethernet, and Fibre Channel
- Coding Theory and Applications, Introduction
- Practical DFT Concepts for ASICs: With Nanometer Test Enhancements



ACCESS TO ONLINE RESOURCES

WEB COMPONENT indicates that classroom instruction is supplemented with online materials or activities. Students enrolling in one of these courses for the first time will receive an e-mail with logon information within 24 hours. However, access to course resources may not be active until one day prior to the course's start date.

Solar Energy Technologies: A Comprehensive Study

X400.078 EE (3.0 quarter units)

This course provides an in-depth study of all aspects of solar technology, including the two principal technologies in use today: concentrating solar thermal power (used in large, utility-scale installations) and photovoltaic systems, including first-generation bulk silicon and second-generation thin-film PV. Students learn device operations, material properties and the system components of amorphous silicon turn-key systems. Developments in compound thin-film semiconductors are presented. The course also covers new technology in solar cells, new methods to improve solar cell efficiency, the world solar market, major solar companies and their products.

Prerequisite(s): A background in science, engineering or experience in an energy-related industry.

WILLIAM KAO, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Wednesdays, 6:30–9:30 pm,
February 1–April 4.
Fee: $480 ($432 through Jan 18).
To enroll, use Section Number 20814.(007)

SystemVerilog for Advanced Design Verification

X400.292 CMPE (3.0 quarter units)

This course covers the advanced features of SystemVerilog and verification methodologies. It begins with an overview of hardware verification methodologies and environments, followed by an examination of process controls and multiple threads in a self-checking verification. Covered next is the object-oriented programming style and design strategies used to reduce design time and risks. Students learn the power of constrained random verification and the use of functional coverage tools to ensure successful verification. Concepts introduced in class are reinforced in the lab with a real-world design project.

Prerequisite(s): A course in SystemVerilog at UCSC Extension and knowledge of VHDL, Verilog, C/C++, and OpenVera, or equivalent hardware verification experience.

BENJAMIN TING, M.S.E.E.

SANTA CLARA LAB
10 meetings: Tuesdays, 6:30–9:30 pm,
January 17–March 20.
Fee: $1020 ($918 through Jan. 3).
To enroll, use Section Number 18966.(016)

Also of Interest

Perl Programming I

For course description, see page 14.

Perl Programming II

For course description, see page 14.

Linux/UNIX Programming and Administration

Certificate Program

Linux/UNIX Programming and Administration

CERTIFICATE CONTACT
Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW
Linux and UNIX are the leading operating systems on workstations and mid-range to high-end systems. They are also fast becoming the OS of choice for an increasing number of embedded systems. Known for their scalability, performance and large installed base, they are capable of supporting many simultaneous users of databases and other GUI applications. The adoption of Linux for new hardware platforms is happening at a fast pace. For these reasons, the need for trained Linux and UNIX professionals will remain strong for the foreseeable future.

The certificate in Linux/UNIX Programming and Administration provides a solid foundation for configuring, operating and creating drivers for these open, multi-user, multi-tasking UNIX operating systems. The courses emphasize the knowledge, skills, and tools needed to perform Linux and UNIX programming and administration in a heterogeneous networked environment. The program is designed for programmers who wish to explore basic and advanced areas of the operating system and system administrators who wish to acquire the skills necessary to effectively perform administration tasks.

CERTIFICATE REQUIREMENTS
To obtain the Certificate in Linux/UNIX Programming and Administration, you must complete **14 units.**

RECOMMENDED COURSE SEQUENCE
If you have limited or no UNIX or Linux experience, we strongly recommend that you begin with "Linux, Introduction."

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

Elective Courses

C Programming for Beginners

For course description, see page 12.

Computer Networking Essentials

For course description, see page 10.

Free Program Overview

Software Development

This free event details our four Software Development certificate programs: Computer Programming, Internet Programming and Development, Software Engineering and Quality, and Linux Programming and Administration. During this interactive session, instructors or staff will highlight new content developments in each area. They will also explain the curriculum, requirements, recommended course sequences, and certificate completion timeframes. In addition to understanding specific training benefits, you will learn how these programs can help you advance your current career or break into a new field.

ANDY HOU.

SANTA CLARA CLASSROOM
Wednesday, 6–8:30 pm, January 11.
Fee: No fee, but enrollment required.
To enroll, use Section Number 3085.(019)

Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

LINUX/UNIX PROGRAMMING AND ADMINISTRATION CERTIFICATE

14-unit minimum

COURSES	Units	Course	F	W	Sp	Su
System Administration						
Linux, Introduction	2.5	2215	■	■	■	■
Linux System and Network Administration	3.0	13515		■		■
Computer Networking Essentials	3.0	2458	■	■	■	■
Linux System Performance and Tuning	3.0	5632	■		■	
VMWare vSPHERE: Configuration and Management [V5.0]	3.5	22869	❍	❍	❍	❍
Cloud Computing, Introduction	0.5	22413	■		■	
Linux Programming						
Linux Systems Programming	3.0	3493	❒	❒	❍	❒
Linux Kernel Architecture and Programming	3.0	1397	❒	❒	❒	❍
Linux Device Drivers	3.0	2470	❒	❒	❒	❒
Linux Device Drivers, Advanced	3.0	1016	■	■	■	■
Embedded Linux Design and Programming, Introduction	3.0	3364	■	■	■	
Linux Kernel Programming, Advanced	2.5	23103	■		■	
Application Programming in Linux/UNIX						
Linux-Based Web Application Development—Apache, MySQL, PHP	3.0	21958	❍	■	❍	■
Perl Programming I	2.0	2856	■	■	■	■
Perl Programming II	2.0	2110		■	■	■
C Programming for Beginners	3.0	5208	❒	❒	❒	❒
Python for Programmers	3.0	3064	❒	❒	❒	❒

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Embedded Linux Design and Programming, Introduction

X467.2 CMPS (3.0 quarter units)

This course covers the fundamentals of building and installing an embedded Linux operating system version 2.6 on an ARM 9 processor platform, and provides hands-on experience for creating cross-platform environments using the GNU tools. Basic concepts for designing, testing, and customizing embedded Linux will be covered, including how the Linux scheduler is implemented, and how to write Linux kernel modules and remotely debug the embedded Linux applications.

Prerequisite(s): Working knowledge of C programming language and UNIX/Linux operating system internals.

SULEMAN SAYA, B.S.

SANTA CLARA CLASSROOM
10 meetings: Thursdays, 6:30–9:30 pm,
January 19–March 22.
Fee: $980 ($882 through Jan. 5).
To enroll, use Section Number 3364.(074)

Linux Based Web Application Development—Apache, MySQL, PHP

X400.510 CMPS (3.0 quarter units)

Linux, Apache, MySQL and PHP, collectively known as LAMP, comprise the majority of servers, databases and scripting languages on the Internet today. LAMP belongs to open-source and is very robust, available free, easily configured, deployed and maintained. This course teaches LAMP basics including installation, deployment and developing a Web site. You will learn the basics of programming MySQL (a popular web database) and PHP (Hypertext Preprocessor, a Web site scripting language). Teaching method includes theory, practices and case studies. You will be able to develop basic to intermediate level 3-tier Web sites and Web applications with a database in the back-end.

Prerequisite(s): Basic knowledge and experience with Web site development on Linux or Windows. "Introduction to Linux" is recommended if you do not have prior Linux experience. Some programming experience will be helpful.

TARAL OZA, M.S.

ONLINE, January 9–April 23.
Fee: $980 ($882 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 21958.(011)

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Mondays, 6:30–9:30 pm,
January 23–April 2 (no meeting Feb. 20).
Fee: $980 ($882 through Jan. 9).
To enroll, use Section Number 21958.(013)

ONLINE, March 5–June 18.
Fee: $980 ($882 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 21958.(012)

Linux Device Drivers

X435.5 CMPE (3.0 quarter units)

This course covers the design and implementation of device drivers for the Linux operating system, and the interfaces to the Linux kernel for writing them. Students will be given an outside project to write a device driver, including the analysis, coding, and debugging of a networking device driver. Topics include compiling the kernel; building and running; character and block device driver concepts; PCI, I/O, and timer routines; hardware management and interrupt handling; networking drivers; PROC file system and IOCTL interface; as well as kernel mechanisms and advanced topics.

Prerequisite(s): A basic knowledge of C language programming. "Linux Kernel Architecture and Programming" or equivalent experience is recommended.

RAGHAV VINJAMURI, B.S.E.E.

ONLINE, January 9–April 23.
Fee: $1020 ($918 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 2470.(088)

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Wednesdays, 6:30–9:30 pm,
January 25–March 28.
Fee: $1020 ($918 through Jan. 11).
To enroll, use Section Number 2470.(090)

ONLINE, March 5–June 18.
Fee: $1020 ($918 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 2470.(089)

Linux Device Drivers, Advanced

X464.6 CMPS (3.0 quarter units)

This course will enhance your understanding of the art of writing Linux device drivers. Students explore the framework that can be used to develop a commercial grade driver. The course includes detailed discussion of the USB and PCI family (PCI-E, PCIe) subsystems, as well as Linux kernel services and facilities. The course includes a board project, and code review of real-world drivers. Additional discussions cover live debugging with Kprobes, profiling with Oprofile, and a survey of industry trends including virtualized drivers, iSCSI and serial IO buses.

Prerequisite(s): "Linux Device Drivers" or equivalent industry experience. This is an advanced course, and the introductory lessons on device drivers will not be repeated in this course.

AMER ATHER, B.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Mondays, 6:30–9:30 pm,
January 30–April 9 (no meeting Feb. 20).
Fee: $1020 ($918 through Jan. 16).
To enroll, use Section Number 1016.(017)

Linux, Introduction

X472. CMPS (2.5 quarter units)

This course introduces the Linux operating system. 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. Students will learn basic Linux administration, Linux file and directory structure, basic

network configuration, and how to utilize office-related tools available in Linux. The course provides students with a hands-on approach for learning Linux through assignments and projects.

SULEMAN SAYA, B.S.

SANTA CLARA LAB
8 meetings: Wednesdays, 6:30–9:30 pm, January 18–February 8; Saturdays, 9 am–12 pm, January 21–February 4; Saturday, 9 am–3:30 pm, February 11.
Fee: $840 ($756 through Jan. 4).
To enroll, use Section Number 2215.(155)

Linux Kernel Architecture and Programming

X458.5 CMPS (3.0 quarter units)

This course provides an introduction to kernel-level programming in Linux and writing kernel modules. Core kernel is covered at both the conceptual and practical/coding levels. The course starts with the kernel source code organization and how it functions. It covers topics in memory management, file systems, process creation and scheduling, interrupts, kernel synchronization, device drivers, and performance tuning. Discussion addresses various data structures and algorithms used in the Linux kernel. Students gain hands-on experience with kernel programming through a class project.

Prerequisite(s): Proficient knowledge of C programming language is required. "Linux System Programming" or equivalent experience is recommended.

SIVA PRASAD, M.S.

ONLINE, January 9–April 23.
Fee: $980 ($882 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 1397.(034)

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm, January 31–April 3.
Fee: $980 ($882 through Jan. 17).
To enroll, use Section Number 1397.(036)

ONLINE, March 5–June 18.
Fee: $980 ($882 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 1397.(035)

Linux System and Network Administration

X400.249 CMPS (3.0 quarter units)

This course provides the foundation for building and maintaining a server for Linux Professionals and System Administrators. The focus of this course will be on basic network configuration, services security, remote access configuration and administration of Linux servers. Students perform basic administrative tasks for users, file systems, security policy, shell and Perl scripts, and network facilities such as NFS, DNS and DHCP. By the end of the course, participants will be able to administer and manage networked services on Linux-based platforms in a business environment.

Prerequisite(s): "Introduction to Linux," a basic knowledge of networks, or comparable industry experience.

SULEMAN SAYA, B.S.

SANTA CLARA LAB
9 meetings: Wednesdays, 6:30–9:30 pm, February 15–March 14; Saturdays, 9 am–12 pm, February 25–March 10, Saturday, 9 am–3:30 pm, March 17 (no meeting Feb. 29).
Fee: $1020 ($918 through Feb. 1).
To enroll, use Section Number 13515.(017)

Linux Systems Programming

X496. CMPS (3.0 quarter units)

System calls are functions called from within a C program, which provide access to the lowest level resources of the OS. Topics covered in this course will enable a C programmer to understand and implement standard utilities (e.g. ls, wc, cat). It includes conceptual background, functional interfaces and topics on I/O control, file systems, access, and docking; signal handling; process and threads management; IPC using pipes and TCP/UDP sockets; and related discussions on makefiles, man pages and rpm packaging utilities. This course covers the development of a complete ftp package, including the client-side interface and the server-side components.

Prerequisite(s): A basic knowledge of C language programming and a working knowledge of the Linux/UNIX operating environment. "Introduction to Linux" is recommended for beginners.

RAGHAV VINJAMURI, B.S.E.E.

ONLINE, January 9–April 23.
Fee: $735 ($661.50 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 3493.(078)

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Thursdays, 6:30–9:30 pm, January 26–March 29.
Fee: $735 ($661.50 through Jan. 12).
To enroll, use Section Number 3493.(080)

ONLINE, March 5–June 18.
Fee: $735 ($661.50 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 3493.(079)

Perl Programming I

For course description, see page 14.

Perl Programming II

For course description, see page 14.

Python for Programmers

For course description, see page 15.

ACCESS TO ONLINE RESOURCES

WEB COMPONENT indicates that classroom instruction is supplemented with online materials or activities. Students enrolling in one of these courses for the first time will receive an e-mail with logon information within 24 hours. However, access to course resources may not be active until one day prior to the course's start date.

VMware vSPHERE: Configuration and Management [V5.0]

X400.431 CMPE (3.5 quarter units)

Server virtualization has become a critical technology to reduce IT costs and support the rise of cloud computing. The VMware vSphere 5.0 course includes lectures and hands-on labs covering the installation, configuration, and management of VMware ESXi 5.0 and vCenter Server 5.0. In hands-on lab sessions, each student has his own ESXi servers, vCenter Server, and SAN storage to create standard and distributed virtual switches, establish storage access, and apply access controls. Virtual machines vMotion, load balancing, and high availability. This course helps prepare students for the VMware Certified 5 Professional (VCP5) exam and satisfies the VCP5 course requirement.

Prerequisite(s): An understanding of basic system administration (OS installation) and networking, including IP addressing and the role of switches and network adapters.

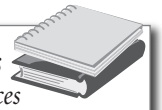
ARMOND INSELBERG, Ph.D.

ONLINE, January 11–March 29.
Fee: $1100 ($990 through Dec. 28).
Enrollment accepted through January 25.
To enroll, use Section Number 22869.(006)

PRACTICAL SYSTEM PROGRAMMING COURSES

Beyond the basics, we are offering practical and hands-on board programming courses for the professionals working in the embedded, consumer, and system development fields.

- Real-Time Embedded Systems Programming, Introduction
- USB Device Interface: Architecture, Protocols and Programming
- Embedded Programming for Video Streaming Applications
- Designing with Xilinx FPGAs, Comprehensive
- Linux Device Drivers, Advanced
- Embedded Linux Design and Programming, Introduction
- Wireless Technologies for Embedded Systems: Bluetooth, WiFi and ZigBee



Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

Network Engineering and Systems Security

The Network Engineering and Systems Security Program combines two previous certificate programs: Network Engineering and Management, and Systems and Network Security. Courses you have previously taken in either program can all apply toward the certificate. The certificate program includes tracks with network and security focuses beyond the fundamental courses.

Certificate Program

Network Engineering and Systems Security

CERTIFICATE CONTACT

Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW

Computer networks are the global platform on which companies conduct business and people communicate. As a result, virtually every industry needs engineering and IT professionals who can design, manage and support networks which deliver competitive advantage and have high security. This certificate program addresses that need with a curriculum that begins with network fundamentals, and then moves on to advanced study in specialized areas of networking and system security. The curriculum is designed to reflect the industry's latest developments and practices. You will acquire career-oriented skills and practical knowledge, and many courses include hands-on learning in our labs.

CERTIFICATE REQUIREMENTS

To obtain the Certificate in Network Engineering and Systems Security, you must complete **14 units**, representing 140 hours of instruction. For additional requirements, go to ucsc-extension.edu.

RECOMMENDED COURSE SEQUENCE

We recommend that you begin with the fundamental courses. Students are expected to satisfy the prerequisites for each course before enrolling in more advanced courses.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

NETWORK ENGINEERING AND SYSTEMS SECURITY CERTIFICATE

14-unit minimum

COURSES	Units	Course	F	W	Sp	Su
Network Engineering Fundamentals						
Computer Networking Essentials	3.0	2458	■	■	■	■
TCP/IP Essentials	2.0	0661	❒	❍	❒	❍
Switching and Routing	3.0	2226		■		■
Wireless Communications, Introduction	3.0	5455	■		■	
Computer, Network and Internet Security Fundamentals	3.0	4100		■		■
Coding Theory and Applications, Introduction	3.0	23389		■	■	
Advanced Networks and System Design						
Network Storage Essentials	3.0	21940	■		■	
Optical Networks Essentials	3.0	3943				■
Smart Grid, Introduction	1.0	22867		■		■
Designing Networks and Systems for High Availability	3.0	4577		■		■
IO Concepts and Protocols: PCI Express, Ethernet and Fibre Channel	3.0	22177	■		■	
Comprehensive Signal and Power Integrity for High-Speed Digital Systems	3.0	22874		■		■
Wireless Technologies for Embedded Systems: Bluetooth, WiFi and ZigBee	3.0	23093	■		■	
USB Device Interface: Architecture, Protocols and Programming	3.0	2179		■		■
Cloud Computing, Introduction	0.5	22413	■		■	
VMware vSPHERE: Configuration and Management [V5.0]	3.5	22869	❍	❍	❍	❍
Systems and Network Security						
Intrusion Detection	3.0	2265	■		■	
Cryptography and Network Security	2.0	19950	■		■	
Information Security: Defending the Business	1.5	22624		■		■
Java Security	1.5	1755	■		■	

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Courses

Coding Theory and Applications, Introduction

X400.134 EE (3.0 quarter units)

This course is an introduction to the basic concepts of coding theory, including practical source and channel encoding/decoding schemes, and emerging technologies in communication theory. Topics include important definitions (entropy, mutual information, channel capacity), lossless and lossy data compression schemes (Huffman codes, arithmetic coding, rate-distortion theory), state-of-the-art error-correcting codes (Hamming codes, turbo codes and Raptor codes), and recent approaches that encompass the duality between data compression and data transmission. This course helps students understand the mechanisms underlying today's communication systems.

Prerequisite(s): Some knowledge of calculus, probability theory and the basics of linear algebra.

CHRISTINE PEPIN, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Mondays, 6:30–9:30 pm,
January 23–April 2 (no meeting Feb. 20).
Fee: $910 ($819 through Jan. 9).
To enroll, use Section Number 23389.(001)

Comprehensive Signal and Power Integrity for High-Speed Digital Systems

For course description, see page 3.

Computer Networking Essentials

X416.6 CMPE (3.0 quarter units)

This foundation course introduces computer networking, networking technologies, and the Internet. It provides a comprehensive survey of the data and computer communications field. Emphasizing both the fundamental principles and the critical role of performance in driving protocol and network design, it explores the technical areas in data communications, wide-area networking, local-area networking, and protocol design. Participants will also gain a strong foundation in networking protocols, hardware, cabling, industry standards, and connectivity solutions. Topics include introduction to the OSI and TCP/IP models of Internet-working; physical layer fundamentals; connectors and cabling; the medium access sublayer and data-link layers; bridging and switching; the network, transport, and upper layers; and network management techniques and technologies.

Prerequisite(s): Some experience with computers and networking.

STEVE ARNOLD, M.B.A.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm,
January 17–March 27 (no meeting Feb. 21).
Fee: $910 ($819 through Jan. 3).
To enroll, use Section Number 2458.(112)

Computer, Network and Internet Security Fundamentals

X431.3 CMPE (3.0 quarter units)

This is a foundation course in computer, network, and Internet security. It provides an in-depth discussion of the traditional security domains, and closely examines the evolving security-threat environment and the tools, techniques, and mitigations available to all types of enterprises and home users. Additional topics include malware (spam, viruses, Trojans, worms, botnets), security protocols, firewalls and remote access, biometrics, virtual private networks, architecture defense, security policy, regulatory issues, voice over IP (VoIP) security issues, and more. Instruction consists of lecture, lab, examples, and demonstrations of tools and techniques.

JIM CARR, M.S., CISSP-ISSAP.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
5 meetings: Saturdays, 9 am–4 pm,
January 28–March 3 (no class meeting on Feb. 18).
Fee: $830 ($747 through Jan. 14).
To enroll, use Section Number 4100.(034)

Designing Networks and Systems for High Availability

X417.6 CMPE (3 quarter units)

After a brief review of the essential network concepts, the course introduces key high-availability solutions and technologies, including DNS round-robin, network appliance load balancing, Web server application balancing, SSL acceleration, server multi-homing, Web caching, RAIDs, virtual machines, database disbursement, and sparing strategies. You will learn current practices as well as developing trends in the industry. Upon completion of this course, you will be equipped with several strategies for designing complex networking systems and meeting the demands of real-world design.

Prerequisite(s): At least some of the fundamental courses in Network Engineering ("TCP/IP Essentials," "Switching and Routing," "Computer Networking Essentials") or equivalent work experience.

ROBERT CARTELLI, M.S.

SANTA CLARA CLASSROOM
10 meetings: Mondays, 6:30–9:30pm,
January 30–April 9 (no meeting Feb. 20).
Fee: $980 ($882 through Jan. 16).
To enroll, use Section Number 4577.(021)

Information Security: Defending the Business

X400.537 CMPS (2.0 quarter units)

This course introduces practical corporate security technologies, covering endpoint, segment and gateway tools including firewalls, intrusion prevention/detection, Unified Threat Management (UTM), security event correlation, data leakage prevention, etc. Students learn end-to-end digital investigation and computer forensics techniques, including what tools fit the SMB or enterprise environments. Students learn the tools used by security professionals to conduct security assessments. This course is for those who want to build corporate security or those interested in transitioning from another IT field into the security profession.

Prerequisite(s): "Computer, Network and Internet Security Fundamentals" or equivalent professional experience.

ABRAHAM CHEN., M.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
8 meetings: Wednesdays, 6–8:30 pm,
February 15–April 4.
Fee: $660 ($594 through Feb. 1).
To enroll, use Section Number 22624.(005)

Smart Grid, Introduction

For course description, see page 4.

Switching and Routing

X408.1 CMPE (3.0 quarter units)

Bridges, switches, and routers comprise the foundational hardware that make up layers 2 and 3. This course focuses on the operation of devices, protocols, and algorithms that make these layers interoperate. Coverage of routing and switching will provide the logic and understanding of how packets are routed through a TCP/IP network and are passed between layers 2 and 3. This course is taught using Cisco routers and switches in the lab. You will gain hands-on experience working with the principle hardware in widest use, including operational premises and algorithmic decisions. You will also learn to configure routing protocols and troubleshoot the network using Cisco IOS commands.

Prerequisite(s): Knowledge of TCP/IP, completion of a data-communication course and a networking course, or equivalent experience.

STEVE ARNOLD, M.B.A.
AHMAD R. YAZDI, M.S.C.S.

SANTA CLARA LAB
10 meetings: Thursdays, 6:30–9:30 pm, February 2–April 5.
Fee: $810 ($729 through Jan. 19).
To enroll, use Section Number 2226.(064)

Free Program Overview

Embedded Systems, VLSI, and Network Engineering

For event description, see page 1.

SANTA CLARA CLASSROOM
Tuesday, 6–8:30 pm, January 10.
No fee, but enrollment required
To enroll, use Section Number 20544.(010)

TCP/IP Essentials

X413.9 CMPE (2.0 quarter units)

TCP/IP has become the primary protocol for connectivity on the Internet and enterprise networks. This course presents an overview of the TCP/IP protocol suite, IP addressing, and subnetting. Participants will also learn about routing concepts, planning and configuring IP address assignment, name-resolution process, and troubleshooting. The course will provide network professionals with the essential knowledge needed to apply the skills on the job. It is intended as a fundamental course for students who are interested in Network Engineering and Management, Systems Administration, Network Security, and Embedded Systems certificate programs.

Prerequisite(s): "Computer Networking Essentials" is recommended (may be taken concurrently), or equivalent knowledge.

SIVA PRASAD, M.S.

ONLINE, January 9–April 23.
Fee: $750 ($675 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 0661.(073)

ONLINE, March 5–June 18.
Fee: $750 ($675 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 0661.(074)

USB Device Interface: Architecture, Protocols and Programming

For course description, see page 4.

VMware vSPHERE: Configuration and Management [V5.0]

For course description, see page 9.

NETWORKING FUNDAMENTALS

Our core Networking courses build a foundation for careers in networking, security, system administration, and embedded systems. We also have a series of courses that will help you stay current in the industry:

- Wireless Communications, Introduction
- Network Storage Essentials
- Optical Networks Essentials
- Coding Theory and Applications, Introduction
- Computer Networking Essentials

Software Development

If you're looking for training in software engineering principles or the latest programming languages, you'll find them at UCSC Extension Silicon Valley. We offer traditional and online courses in a variety of programming languages, object-oriented programming, Java, and .NET. We also offer certificates and courses in software engineering and in today's most popular OS platforms, including UNIX, Linux, and Windows. Our courses and certificates are designed to help Bay Area technical professionals develop and advance skills to stay competitive throughout their careers.

Certificate Program

Computer Programming

CERTIFICATE CONTACT

Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW

Software applications are deployed in nearly every facet of modern life. This has created a corresponding need for technical professionals who can create, maintain, and troubleshoot these applications.

Our Certificate in Computer Programming not only provides a solid foundation of knowledge in the computer-programming field, it goes beyond the fundamentals to teach professionals how to apply that knowledge to various platforms and applications in the industry. Courses explain basic mechanisms and emphasize programming practices that reduce maintenance costs, optimize the code, and enable the creation of reusable software components. Advanced courses strengthen the concepts that experienced programmers already possess; and the knowledge gained can be applied immediately on the job.

CERTIFICATE REQUIREMENTS

To obtain the Certificate in Computer Programming, you must complete **14 units**, representing 140 hours of instruction. For additional requirements, go to ucsc-extension.edu.

PREREQUISITES

Refer to individual course descriptions for prerequisites, where applicable.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

COMPUTER PROGRAMMING CERTIFICATE

14-unit minimum	Units	Course	F	W	Sp	Su
C Programming						
C Programming for Beginners	3.0	5208	❒	❒	❒	❒
C Programming, Advanced	3.0	3948	❍	❒	❍	❍
C++ Programming						
C++ Programming, Comprehensive	3.0	18344	■	■	■	■
Data Structures and Algorithms Using C++	3.0	4732	■		■	
.NET Programming						
C# .NET Programming, Comprehensive	3.0	5408	■	❍	■	❍
C# .NET Programming, Advanced	3.0	19026	❍	■	❍	❍
Visual Basic Programming, Comprehensive	3.0	2874	❍	❍	❍	❍
Developing UI for Windows and the Web with WPF and Silverlight	2.0	20027			■	
Java Programming						
Programming with Java for Beginners	1.5	5185	❒	❍	❒	❍
Java Programming, Comprehensive	3.0	6634	❒	❒	❒	❒
XML Essentials	2.0	3279	❍	❍	❍	❍
JUnit Test Framework	1.5	6198	❒	❍	❒	❍
Scripting Languages						
Perl Programming I	2.0	2856	■	■	■	■
Perl Programming II	2.0	2110		■	■	■
Python Programming for Beginners	1.5	20776	■	■	■	■
Python for Programmers	3.0	3064	❒	❒	❒	❒
PHP (Hypertext Preprocessor)	2.0	21343	❒	❒	❒	❒
Mobile Device Programming						
Developing Applications for iPhone, iPad and iPod Touch, Introduction	3.0	21938	■	■	■	■
Developing Applications for iPhone, iPad and iPod Touch: Practicum	1.5	30001	■		■	
Developing Advanced Applications for iPhone, iPad and iPod Touch	3.0	23592		■		■
Developing Applications for Android Mobile Devices	3.0	21956	■	■	■	■
Developing Advanced Applications for Android Mobile Devices	3.0	30002	■		■	
Advanced Programming						
Multicore Programming	2.0	22180	■		■	
Object-Oriented Analysis and Design	3.0	0774	❍	❒	❍	❒
Object-Oriented Development: Architectures and Design Patterns, Advanced	3.0	6633		■		■
Machine Learning and Data Mining, Introduction	3.0	2612	■	■		
Computational Intelligence	1.5	19951		■		■

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Courses

C Programming for Beginners

X409.1 CMPS (3.0 quarter units)

This course will benefit 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 the functions, data types, input/output, strings, operators, precedence, and expressions. It also demonstrates the use of control statement, 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.

Prerequisite(s): Technical aptitude and experience with a computer operating system or equivalent knowledge.

BINEET SHARMA, M.S.

ONLINE, January 9–April 23.
Fee: $620 ($558 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 5208.(102)

ONLINE, March 5–June 18.
Fee: $620 ($558 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 5208.(103)

SANTA CLARA LAB
10 meetings: Fridays, 6:30–9:30 pm,
January 20–March 23.
Fee: $620 ($558 through Feb. 6).
To enroll, use Section Number 5208.(104)

C Programming, Advanced

X401.7 CMPS (3.0 quarter units)

This course will broaden your skills as a C language programmer by introducing sophisticated problem-solving techniques, including the advanced use of pointers, abstract data types, data structure concepts and optimization techniques. This course delves into the design, implementation, and use of advanced data structures, based on primitive

data types. Students will solidify their understanding of strings, arrays, structures, unions and bit manipulation. Emphasis will be on programming that employs and improves upon a variety of data structures. Through this course, you will learn to write efficient programs by understanding the complexities of various algorithms.

Prerequisite(s): "C Programming for Beginners" or an equivalent course. Students should have a good understanding of programming using data types such as pointers, control flow, structures and functions.

RAJAINDER A. YELDANDI, M.S.

ONLINE, January 9–April 23.
Fee: $800 ($720 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 3948.(035)

SANTA CLARA CLASSROOM
10 meetings: Saturdays, 9 am–12 pm, January 21–April 7 (no meetings Feb. 18 and Mar. 10).
Fee: $800 ($720 through Jan. 7).
To enroll, use Section Number 3948.(037)

ONLINE, March 5–June 18.
Fee: $800 ($720 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 3948.(036)

C++ Programming, Comprehensive

X400.348 CMPS (3.0 quarter units)

C++ is a general-purpose object-oriented programming language that offers portability, speed, and modularity, as well as compatibility with C and other languages. An excellent foundation in developing optimized C++ applications, this course offers participants the opportunity to write faster code, learn debugging techniques, and deliver modular code for real-world applications. Topics include object-oriented concepts; structure and input/output streams; declarations, identifiers, pointers, and arguments; memory management, constructors, and destructors; enumeration type, as constructor parameter; character strings, file I/O, functions; inheritance, and interaction diagrams; and exception handling, pointers, and functions.

Prerequisite(s): Experience with C programming language.

SULEMAN SAYA, B.S.

SANTA CLARA CLASSROOM
10 meetings: Tuesdays, 6:30–9:30 pm, January 17–March 20.
Fee: $1020 ($918 through Jan. 3).
Enrollment accepted through February 13.
To enroll, use Section Number 18344.(023)

C# .NET Programming, Comprehensive

X459.1 CMPS (3.0 quarter units)

This course introduces beginning and intermediate programmers to .NET programming using Microsoft's C# programming language. The instructor explains the Visual Studio development environment and reviews the basic constructs of C# language with detailed explanations of the C# regular expressions, delegates, events, generics and collections. The course also covers exception handling, threading and synchronization. Sample applications will be used to illustrate core concepts and the instructor will present real-world code examples in class.

Prerequisite(s): Some programming experience with a high-level language such as C, C++, Java or Visual Basic. C# knowledge is not required.

TARAL OZA, M.S.

ONLINE, January 9–April 23.
Fee: $910 ($819 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 5408.(056)

ONLINE, March 5–June 18.
Fee: $910 ($819 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 5408.(057)

C# .NET Programming, Advanced

X400.376 CMPS (3.0 quarter units)

For students who have learned the basic C# language and the C#.NET integrated development environment, this course provides an opportunity to expand C# and .NET skills by learning advanced C# features and programming techniques. The course introduces the components of the .NET framework, database connectivity and Web application development.

Prerequisite(s): "C# .Net Programming, Comprehensive" or equivalent experience.

TARAL OZA, M.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Thursdays, 6:30–9:30 pm, January 19–March 22.
Fee: $910 ($819 through Jan. 5).
To enroll, use Section Number 19026.(007)

Computational Intelligence

X400.393 CMPS (1.5 quarter units)

Computer professionals are required to solve increasingly complex problems. "Black-box" computational-intelligence tools can be configured to allow their application to problems, without the user's intimate knowledge of the low-level details. You will learn the strengths and weaknesses of various computational and artificial intelligence techniques, with emphasis on their application to actual problems. This course is well suited to computer professionals who want to explore new techniques for solving problems that are ill-defined, have conflicting constraints, or contain data with high noise levels. Topics include neural networks, genetic algorithms, genetic programming, swarm intelligence, and fuzzy systems.

Prerequisite(s): Experience with a computer language and basic algebra skills.

THOMAS POLIQUIN, B.S.E.E.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
5 meetings: Tuesdays, 6:30–9:30 pm, February 28–March 27.
Fee: $730 ($657 through Feb. 14).
To enroll, use Section Number 19951.(012)

Free Program Overview

Software Development

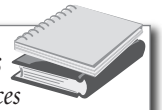
This free event details our four Software Development certificate programs: Computer Programming, Internet Programming and Development, Software Engineering and Quality, and Linux Programming and Administration. During this interactive session, instructors or staff will highlight new content developments in each area. They will also explain the curriculum, requirements, recommended course sequences, and certificate completion timeframes. In addition to understanding specific training benefits, you will learn how these programs can help you advance your current career or break into a new field.

ANDY HOU.

SANTA CLARA CLASSROOM
Wednesday, 6–8:30 pm, January 11.
Fee: No fee, but enrollment required.
To enroll, use Section Number 3085.(019)

ACCESS TO ONLINE RESOURCES

WEB COMPONENT indicates that classroom instruction is supplemented with online materials or activities. Students enrolling in one of these courses for the first time will receive an e-mail with logon information within 24 hours. However, access to course resources may not be active until one day prior to the course's start date.



Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

Developing Applications for Android Mobile Devices

X400.507 CMPS (3.0 quarter units)

Android is an open source mobile platform supported by Google and OHA. This course begins with an overview of the Android development platform. An example application will be used to demonstrate how to build applications for the new platform. The course explains in detail the platform architecture, the basic mobile building blocks, how to program it with Java code, debugging, implementing the UI, and using the optional APIs and Google libraries to enrich the application. Students learn through programming assignments.

Prerequisite(s): Java Programming experience is required. Linux experience is not required.

TARAL OZA, M.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm,
January 24–March 27.
Fee: $910 ($819 though Jan. 10).
To enroll, use Section Number 21956.(012)

Developing Applications for iPhone, iPad and iPod Touch, Introduction

X400.503 CMPS (1.5 quarter units)

The course provides an overview of using the iOS SDK to develop iPhone, iPad, and iPod Touch applications. It begins with discussion of Xcode and Objective-C. Students learn various iOS programming frameworks, user interface development, memory management and program design. The App Store submission process and guidelines are covered. Discussions also delve into special considerations for the iPad and iPod Touch. Upon completing this course, students have a solid understanding of the iOS SDK and the ability to do application development.

Prerequisite(s): C Programming and knowledge of an object-oriented programming language such as Java or C++.

MICHAEL PATRICK ELLARD, M.A.
DAVID OSTER, M.S.E.E.

SANTA CLARA LAB
5 meetings: Wednesdays, 6:30–9:30 pm,
February 29–March 28.
Fee: $625 ($562.50 through Jan. 11).
To enroll, use Section Number 21938.(014)

Developing Advanced Applications for iPhone, iPad and iPod Touch

X400.577 CMPS (1.5 quarter units)

If you're ready to design and develop advanced applications for iOS, this course provides the knowledge you need. It covers Core Data in depth, as well as the use of XML and SQLite databases. The course addresses network and web-based APIs, including communicating with Web services, mobile Web sites, and iCloud. You will learn to incorporate camera functions, images and videos in applications, along with the gesture recognizer, device orientation, and motion sensors. You will analyze several interesting iPhone/iPad applications to gain insight into practical uses, and build additional experience by designing and developing an advanced programming project.

Prerequisite(s): "Developing Applications for iPhone, iPad and iPod Touch" or equivalent experience.

JEFF MILLER, B.S.C.S.

SANTA CLARA CLASSROOM
10 meetings: Thursdays, 6:30–9:30 pm,
March 29–May 31.
Fee: $980 ($882 through Mar. 15).
To enroll, use Section Number 23592.(001)

JUnit Test Framework

For course description, see page 20.

Java Programming, Comprehensive

X471.2 CMPS (3.0 quarter units)

Java is the premier language for Web servers, enterprise servers, network applications, embedded devices, appliances and wireless applications. This course covers the Java fundamentals, including language syntax, constructs, and the development environment. It also extends to the Java platform, including client/server communication and managing XML data. The course begins with Java's implementation of object-oriented concepts such as classes, data and function access controls and inheritance. Students build graphical user interfaces and program in the Java event-handling model. Additional topics include the Java class library, collection frameworks, Internet communication, and multithreaded programming.

Prerequisite(s): Experience in a programming language such as C, C++ or Visual Basic. "Programming with Java for Beginners" is recommended for those new to Java.

AHMAD NOURI, M.S.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Fridays, 6:30–9:30 pm,
January 20–March 23.
Fee: $1020 ($918 through Jan. 6).
To enroll, use Section Number 6634.(054)

ONLINE, January 9–April 23.
Fee: $1020 ($918 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 6634.(052)

ONLINE, March 5–June 18.
Fee: $1020 ($918 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 6634.(053)

Machine Learning and Data Mining, Introduction

X470.3 CMPS (3.0 quarter units)

Machine Learning automatically recognizes complex patterns in all types of data. This survey course covers the concepts and principles of a large variety of data mining methods. The course covers both supervised and unsupervised learning concepts. The supervised techniques include various types of linear regression, decision trees, k- nearest neighbors, Naive Bayes, Support Vector Machines, and ensemble methods. The course also addresses unsupervised techniques such as k-means, expectation maximization, and density based clustering.

Prerequisite(s): A moderate level of computer programming proficiency, and an elementary understanding of probability, statistics, linear algebra, and calculus.

PATRICIA HOFFMAN, Ph.D.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm,
January 31–April 3.
Fee: $950 ($855 through Feb. 17).
To enroll, use Section Number 2612.(005)

Object-Oriented Analysis and Design

For course description, see page 21.

Object-Oriented Development: Architectures and Design Patterns, Advanced

For course description, see page 21.

PHP (Hypertext Preprocessor)

For course description, see page 19.

Perl Programming I

X423.2 CMPS (2.0 quarter units)

This course introduces users, programmers and system administrators to the popular interpreted language called Perl, the Practical Extraction and Report Language. Perl is hailed as the system administrator's language and is the de facto standard for writing dynamic Web pages. This practical course is also useful for anyone working with UNIX text files, databases and processes. Although the course is taught on a UNIX system, Perl is very portable. The fundamental topics covered in this course are data types, operators, regular expressions and pattern handling, conditional and looping constructs, file handles and filters, file testing, command-line arguments, subroutines and packages, the UNIX system interface, formatting and database management files.

Prerequisite(s): Some prior programming experience required.

ELLIE QUIGLEY, B.A.

SANTA CLARA LAB
3 meetings: Monday–Wednesday, 9 am–5 pm,
February 13–15.
Fee: $760 ($684 through Jan. 31).
To enroll, use Section Number 2856.(118)

Perl Programming II

X436.9 CMPS (2.0 quarter units)

This hands-on course is designed for those interested in advanced applications for Perl. It is a highly beneficial continuation of the "Perl Programming I" course. Students learn to read and write Perl modules, both procedural and object oriented. Topics covered include Perl subroutines and packages, references (pointers), objects, modules, pragmas and the standard Perl library. Students learn how to document their programs using Perl's Plain Old Documentation format and store them in a library. There will be an overview of the Perl DBI for connecting to any database and performing SQL queries, retrieving result sets, and displaying the results in a browser using the CGI.pm module.

Prerequisite(s): "Perl Programming I" or equivalent knowledge.

ELLIE QUIGLEY, B.A.

SANTA CLARA LAB
3 meetings: Monday–Wednesday, 9 am–5 pm,
March 12–14.
Fee: $760 ($684 through Feb 27).
To enroll, use Section Number 2110.(047)

Programming with Java for Beginners

X439.3 CMPS (1.5 quarter units)

This course is intended for those who are new to programming or need a refresher. Java, a widely popular programming language, will be used to generate solutions to real, practical problems. The course begins with the concepts of programming, computer science, and software engineering. It introduces the basic Java syntax, and then delves into abstraction, the object-oriented paradigm, procedural programming, elementary data structures, and more. Students will gain a strong foundation and learn to write programs for real applications. The course includes lab exercises.

Prerequisite(s): No programming experience is required. Students should have amplitude in logic thinking.

EDWIN MACH, M.S.

ONLINE, January 9–April 23.
Fee: $550 ($495 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 5185.(053)

ONLINE, March 5–June 18.
Fee: $550 ($495 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 5185.(054)

Python Programming for Beginners

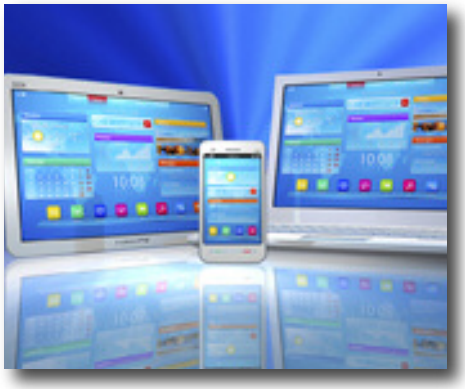
X400.463 CMPS (2.0 quarter units)

This course is intended for newcomers to programming. It covers the important concepts and programming mechanisms that exist in all programming languages: reading and writing to standard I/O, using operators, controlling the flow of execution, using functions, reading and writing files, and object-oriented programming concepts. It also includes Python specific facilities such as code re-use, built-in sequence types, and iteration. This is a hands-on lab-based course. Interactions and expert help are available.

MARILYN DAVIS, Ph.D.

SANTA CLARA LAB
3 meetings: Fridays, 9 am–4 pm,
January 27–February 10.
Fee: $520 ($468 through Jan. 13).
To enroll, use Section Number 20776.(013)

SANTA CLARA LAB
6 meetings: Thursdays, 6–9 pm, January 19–February 23.
Fee: $520 ($468 through Jan. 5).
To enroll, use Section Number 20776.(014)



Python for Programmers

X461.9 CMPS (3.0 quarter units)

Because of its clear and elegant syntax, dynamic typing, automatic memory management, and straight-forward module architecture, Python enhances program correctness and increases efficiency. Its code is easy to read, write, extend, and modify. This lab-based course builds proficiency in Python, and the skills and knowledge for creating applications using task-specific Python libraries. Topics include the Python environment and code introspection, syntax, flow control, function protocols, exception handling and functional programming. Also covered are object-oriented features, classes, inheritance and overriding; as well as building applications, packages, and libraries.

Prerequisite(s): Significant experience in any programming language or "Python Programming for Beginners."

MARILYN DAVIS, Ph.D.
CASEY THE.

ONLINE, January 9–April 23.
Fee: $1020 ($918 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 3064.(043)

MARILYN DAVIS, Ph.D.

SANTA CLARA LAB
9 meetings: Tuesday, 6–9:30 pm,
January 17–March 27 (no meetings Feb. 14 and Mar. 6).
Fee: $1020 ($918 through Jan. 3).
To enroll, use Section Number 3064.(046)

SANTA CLARA LAB
4 meetings: Monday–Thursday, 9 am–5 pm,
February 27–March 1.
Fee: $1020 ($918 through Feb. 13).
To enroll, use Section Number 3064.(045)

ONLINE, March 5–June 18.
Fee: $1020 ($918 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 3064.(044)

Visual Basic Programming, Comprehensive

X456.8 CMPS (3.0 quarter units)

This course introduces the student to object oriented programming techniques in a Windows environment. The fundamentals of event driven programming are covered using the Rapid Application Development tool Visual Basic (VB). Planning, programming and debugging VB applications using modern programming techniques and practicing good graphical user interface design are emphasized.

Prerequisite(s): Practical programming experience in any high-level language. Prior knowledge of Visual Basic is not required.

TANWEER HAROON, M.S.

ONLINE, January 9–April 23.
Fee: $700 ($630 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 2874.(053)

ONLINE, March 5–June 18.
Fee: $700 ($630 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 2874.(054)

XML Essentials

X468.4 CMPS (2.0 quarter units)

This course is an introduction to the power of XML and its importance to the Web. The course begins with the history and background of XML and the advantages of moving toward the XML standard. The course introduces basic tags as well as syntax rules for XML and XML environments. Practical examples will be used to demonstrate the basics of working with XML, cascading style sheets and document-type definitions. The course briefly addresses the Document Object Model (DOM) concept and the data manipulation capability.

Prerequisite(s): Web page creation skills and a basic understanding of cascading style sheets.

AHMAD NOURI, M.S.

ONLINE, January 9–April 23.
Fee: $625 ($562.50 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 3279.(028)

ONLINE, March 5–June 18.
Fee: $625 ($562.50 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 3279.(029)

MOBILE DEVICE PROGRAMMING

Learn to develop applications for the hottest smart phones. Build your skill-set for this emerging market with course work ranging from basic to advanced.

- Developing Applications for iPhone, iPad and iPod Touch (see page 14)
- Developing Applications for Android Mobile Devices (see page 14)
- Developing Advanced Applications for iPhone, iPad and iPod Touch (see page 14)
- Developing Advanced Applications for Android Mobile Devices (coming soon)

Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

Certificate Program

Database Systems

CERTIFICATE CONTACT
Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

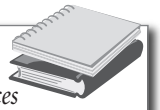
PROGRAM OVERVIEW
Most businesses today use some form of shared data to serve the needs of their enterprise. Many database management system (DBMS) products have been developed to meet these needs. The need for qualified professionals to manage these systems has never been greater.

Our Certificate in Database Systems is designed for technical professionals who want to enrich their careers by learning the principles and practices involved in designing, administering, tuning, and using shared databases. The certificate will provide you with not only broad, general knowledge of database systems and concepts, but also state-of-the-art practical skills needed by DBMS professionals. Whether your focus is installing a database management system, using data warehousing or data mining techniques to provide decision support information or writing programs that interface with a DBMS, this combination of general and practical knowledge will prepare you to take on challenging DBMS positions in today's technology-dependent workplace.

CERTIFICATE REQUIREMENTS
To obtain the Certificate in Database Systems, you must complete "Relational Database Essentials," plus **five elective courses** for a minimum total of **14 units**. For additional requirements, go to ucsc-extension.edu.

RECOMMENDED COURSE SEQUENCE
We recommend that students begin with "Relational Database Essentials" and that numbered courses (those ending in I, II and III) be taken in consecutive order. Otherwise, you may take courses in this program in any order and in any combination.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.



Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

DATABASE SYSTEMS CERTIFICATE

14-unit minimum

REQUIRED COURSE	Units	Course	F	W	Sp	Su
Relational Database Essentials	3.0	6195	❒	❒	❒	❒

ELECTIVE COURSES	Units	Course	F	W	Sp	Su
Oracle Database						
Oracle SQL Programming, Introduction	3.0	3053		■		■
Oracle PL/SQL, Introduction	3.0	21320			■	
Oracle 11g: Enterprise Architecture and Administration on Linux	3.5	19069	■	■		
Oracle 11g: Administration II on Linux	4.0	19070		■	■	
MySQL Database						
MySQL Database Administration I	2.0	23095		■		■
MySQL Database Administration II	2.0	23228	■		■	
MySQL Database for Developers and Designers	3.0	22632	■		■	
Linux-Based Web Application Development—Apache, MySQL, PHP	3.0	21958	❍	❒	❍	❒
Database Programming and Applications						
Data Warehouse Solutions and Business Intelligence	2.0	3502	■		■	
Machine Learning and Data Mining, Introduction	3.0	2612	■	■		
Data Mining	5.0	20294			■	
PHP (Hypertext Preprocessor)	2.0	21343	❒	❒	❒	❒
XML Essentials	2.0	3279	❍	❍	❍	❍
Enterprise Application Performance Management (APM) for Java EE and .NET Platforms	1.5	4412		■		■

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Required Course

Relational Database Essentials

X466.3 CMPS (3.0 quarter units)

Any application that needs to process and store large amounts of information will likely use a commercial database management system (DBMS). This course provides in-depth knowledge of the concepts behind a DBMS, and then focuses on issues related to practical database design. Students learn how to create conceptual, logical and physical designs of relational databases in response to a set of user requirements. The course will lay a solid foundation for technical professionals and others who want to pursue a career in databases and apply that knowledge to the next level of SQL Server and Oracle series of classes. Topics include relational database concepts, entity-relationship model, normalization, SQL fundamentals, and data warehouse fundamentals.

Prerequisite(s): Familiarity with general database issues.

MOHAMMAD NAVEED, M.S., M.B.A.

ONLINE, January 9–April 23.
Fee: $980 ($882 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 6195.(056)

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
10 meetings: Tuesdays, 6:30–9:30 pm, January 24–March 27.
Fee: $980 ($882 through Jan. 10).
To enroll, use Section Number 6195.(058)

ONLINE, March 5–June 18.
Fee: $980 ($882 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 6195.(057)

Elective Courses

Enterprise Application Performance Management (APM) for Java EE and .NET Platforms

For course description, see page 18.

Machine Learning and Data Mining, Introduction

For course description, see page 14.

Linux Based Web Application Development—Apache, MySQL, PHP

For course description, see page 8.

Free Program Overview

Database Systems

From small offices to large corporations, databases play an important role in information access. This program overview presents the basics of relational databases. The presentation includes terminology used in the industry, the fundamentals of databases, design issues, the concept of relational databases, searching, and running queries to generate reports. Several commercial products such as Oracle and Microsoft SQL Server 2005 will also be discussed. The event will provide an overview of the Database Systems certificate program offered at UCSC Extension. You will hear about our lab-based curriculum and have a chance to ask questions.

ANDY HOU.

SANTA CLARA CLASSROOM
Thursday, 6:30–9:30 pm, January 12.
No fee, but enrollment required.
To enroll, use Section Number 3212.(015)

MySQL Database Administration I

X400.556 CMPS (2.0 quarter units)

MySQL has been widely adopted for use in enterprise and Web applications. This foundation course begins with an overview of MySQL server, including installation, configuration and metadata access. It covers user account management, including security and access privileges. Students will learn the backup and recovery features and techniques, and how to review server logs. The course introduces the various types of storage engines, query cache configuration, various client utility programs, and the underlying configuration parameters which play important roles in query performance and database tuning. Each class meeting includes a lab session.

Prerequisite(s): "Relational Database Essentials" or equivalent knowledge.

MOHAMMAD NAVEED, M.S., M.B.A.

SANTA CLARA LAB
7 meetings: Thursdays, 6:30–9:30 pm,
February 16–March 29.
Fee: $740 ($666 through Feb. 2).
To enroll, use Section Number 23095.(003)

Oracle 11g: Enterprise Architecture and Administration on Linux

X400.377 CMPS (3.5 quarter units)

Oracle DBAs manage the industry's most advanced information systems and command some of its highest salaries. This course is your first step toward success as an Oracle professional, by giving you a firm foundation in basic database administration. You'll learn how to install and maintain an Oracle database, and how to create an operational database and properly manage the various structures including performance monitoring, database security, user management, and backup/recovery techniques. This course is designed to prepare you for the corresponding Oracle Certified Associate exam. Topics include installing Oracle Database 11g Software, creating an Oracle Database, database interfaces and controls, storage structures, administering users, managing data and schema objects, undoing management, and Oracle net services, shared server, and backups.

Prerequisite(s): "Relational Database Essentials." "Introduction to Linux" is recommended, but not required.

RAGHAV VINJAMURI, B.S.E.E.

SANTA CLARA LAB
5 meetings: Saturdays, 9 am–5 pm,
January 21–February 25 (1 no meeting TBA).
Fee: $1010 ($909 through Jan. 7).
To enroll, use Section Number 19069.(013)

Oracle 11g: Administration II on Linux

X400.378 CMPS (4.0 quarter units)

In this course, you'll learn how to configure an Oracle database for multilingual applications and practice various methods of recovering the database using RMAN, SQL, and Flashback technology. Tools to monitor database performance and what steps to take to improve database performance are covered as well as how to use various database technologies, such as Resource Manager, Scheduler, and Automatic Storage Management (ASM). Topics include using globalization support, securing the Oracle listener, diagnostic sources, and automating tasks with the scheduler. The course is designed to prepare you for the corresponding Oracle Certified Professional exam.

Prerequisite(s): "Oracle 11g: Enterprise Architecture and Administration on Linux."

RAGHAV VINJAMURI, B.S.E.E.

SANTA CLARA LAB
6 meetings: Saturdays, 9 am–4:30 pm,
March 17–April 28 (1 no meeting TBA).
Fee: $1020 ($918 through Mar. 3).
To enroll, use Section Number 19070.(011)

Oracle SQL Programming, Introduction

X445.5 CMPS (3.0 quarter units)

This course teaches students how to define and manipulate data in an Oracle database using SQL programming. It also includes methods for producing readable output, creating and manipulating tables, as well as creating and managing constraints. It lays the foundation for learning more specific Oracle products such as iSQL*Plus or SQL Developer. Topics include writing SQL, sorting data, aggregating data, multitable operations, subqueries, and hierarchical retrieval. This is an interactive hands-on lab course with instructors.

Prerequisite(s): "Relational Database Essentials" and a general understanding of Oracle database.

FAYSAL SHAARANI, M.B.A.

SANTA CLARA LAB
10 meetings: Wednesdays, 6:30–9:30 pm,
February 1–April 4.
Fee: $780 ($702 through Jan. 18).
To enroll, use Section Number 3053.(040)

PHP (Hypertext Preprocessor)

For course description, see page 19.

XML Essentials

For course description, see page 15.

Certificate Program

Internet Programming and Development

CERTIFICATE CONTACT
Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW
Internet technology has evolved rapidly in recent years and will likely continue this trend into the future. This certificate program encompasses the major frameworks on the Internet today. It provides comprehensive training for professionals working on e-commerce, enterprise applications, and interactive Web sites.

Java EE is the platform originated by Sun MicroSystems. It is a set of specifications, patterns and practices that define distributed, multi-tiered application development, deployment, and management for the Java programming language. While it remains a key technology, in recent years other frameworks have emerged to support the applications server and associated development environment. Examples include Microsoft .NET, and various open-sourced frameworks. There is also a trend toward moving more processing to the client side. Knowledge of such platforms is essential for developers to stay ahead in implementation and deployment of these continuously evolving and challenging technologies.

This program shares courses with our certificates in Computer Programming, Web Design and Development, and Linux Programming. It is the one place where important Internet development and application programming courses are combined in a single, rich curriculum.

CERTIFICATE REQUIREMENTS
To obtain the certificate in Internet Programming and Development, you must complete a minimum total of **14 units**, including one of the three core courses. In order to be eligible for this certificate, you must (1) complete all course work within three years of filing the application to establish candidacy, and (2) achieve an overall 3.0 grade point average (GPA) for all courses. In addition, all courses applying toward the certificate must have been successfully completed within five years of the date on which the certificate is issued.

CERTIFICATE APPLICATION INFORMATION
We encourage you to establish candidacy in a certificate program early in your studies. The benefits of declaring candidacy early include notification of updates to the program. Certificate applications can be submitted online. An application fee, listed on the Web page, is required to establish candidacy.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

Courses

C# .NET Programming, Comprehensive

For course description, see page 13.

INTERNET PROGRAMMING AND DEVELOPMENT CERTIFICATE

14-unit minimum

*Choose one of these three core courses	Units	Course	F	W	Sp	Su
Internet Architecture						
Web Technologies, Introduction	1.0	22623		■		■
Cloud Computing, Introduction	0.5	22413	■		■	
Programming for Cloud Computing: Amazon Web Services	1.5	23094		■		■
User Experience Design for Web Applications	2.0	3113	■		■	
Java EE Framework						
* Enterprise Solutions Using Java EE	3.0	6933	■	■	■	■
Developing Java and Java EE Applications with Spring Framework	3.0	20063	■		■	
Java Programming, Comprehensive	3.0	6634	❒	❒	❒	❒
Enterprise Application Performance Management (APM) for Java EE and .NET Platforms	1.5	4412		■		■
Java Security	1.5	1755	■		■	
Rich Internet Applications						
* JavaScript and AJAX, Comprehensive	3.0	1500		■		■
Developing JavaScript-based Rich Web UI with JQuery	2.0	22865	■		■	
Developing UI for Windows and the Web with WPF and Silverlight	2.0	20027			■	
.NET Framework						
C# .NET Programming, Comprehensive	3.0	5408	■	❍	■	❍
C# .NET Programming, Advanced	3.0	19026	❍	■	❍	❍
Open Source Framework						
* Linux Based Web Application Development—Apache, MySQL, PHP	3.0	21958	❍	❒	❍	❒
Ruby and Ruby on Rails, Advanced	2.0	21342	■	❍	■	❍
Web Application Development with Groovy and Grails	2.0	23390		■		■
Internet Programming Languages						
Programming with Java for Beginners	1.5	5185	❒	❍	❒	❍
Ruby, Introduction	0.5	21341	■	■	■	■
PHP (Hypertext Preprocessor)	2.0	21343	❒	❒	❒	❒
Perl Programming I	2.0	2856	■	■	■	■
Perl Programming II	2.0	2110		■	■	■
Python Programming for Beginners	1.5	20776	■	■	■	■
Python for Programmers	3.0	3064	❒	❒	❒	❒
HTML/XHTML: Building Blocks for Web Development	2.0	20816	❍	❒	❍	❒
Designing with Cascading Style Sheets I	1.5	6673	❍	■	❍	■
XML Essentials	2.0	3279	❍	❍	❍	❍

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

C# .NET Programming, Advanced

For course description, see page 13.

Designing with Cascading Style Sheets (CSS) I

For course description, see page 25.

Enterprise Application Performance Management (APM) for Java EE and .NET Platforms

X423.9 CMPE (1.5 quarter units)

Application Performance Management (APM) has become a key competency for IT professionals and software developers. This course begins with the concepts of APM, including the architecture and the characteristics of availability and transaction management. It introduces tools for performance profiling and load testing. Application server tuning with Sun JVM and IBM JVM is described, along with memory leak triaging techniques. The course covers APM implementation and production management processes such as alerts, trending and capacity planning. Examples are used to demonstrate common performance problems with Java EE and .NET CLR.

SRIKAR ACHANTA, M.S., M.B.A.

SANTA CLARA CLASSROOM
6 meetings: Tuesdays, 6:30–9:30 pm,
January 24–March 6.
Fee: $700 ($630 through Jan. 10).
To enroll, use Section Number 4412.(025)

Enterprise Solutions Using Java EE

X400.004 CMPS (3.0 quarter units)

Java Enterprise Edition supports the development of robust, secure and scalable Web-based enterprise business applications. The course starts with the Java technologies used in Web applications, including Servlet, JSP, JBoss application server and database API. It introduces the Struts framework for implementing Java EE Web applications. Emphasis will be on the current Enterprise JavaBeans (EJB) 3 release and its powerful Java Persistence API. The course covers message services, interceptors, injection, transactions, Web services and security. Students will gain hands-on experience with tools, servers and databases.

Prerequisite(s): "Java Programming, Comprehensive" or an equivalent course. Familiarity with the Web and software installation is assumed.

GERALD COMISAR, Ph.D.

SANTA CLARA LAB
10 meetings: Saturdays, 9 am–12 pm,
January 21–March 31 (no meeting Feb. 18).
Fee: $1020 ($918 through Jan. 7).
To enroll, use Section Number 6933.(027)

HTML/XHTML: Building Blocks for Web Development

For course description, see page 25.

Java Programming, Comprehensive

For course description, see page 14.

JavaScript and AJAX, Comprehensive

X438.5 CMPS (3.0 quarter units)

This comprehensive course covers JavaScript as a programming language for creating dynamic Web pages. After getting up to speed with the language syntax, data types, operators, and programming constructs, students learn how to integrate JavaScript with HTML/CSS and write functions to handle user-initiated events such as mouse rollovers, clicking on a link, or submitting a form. Students learn the Document Object Model and how to walk the W3C DOM tree, manage nodes, and use event listeners. AJAX is introduced to create asynchronous calls to the Web for fast interactivity.

Prerequisite(s): Some programming experience and knowledge of basic HTML or CSS. A background in object oriented programming is helpful.

ELLIE QUIGLEY, B.A.

SANTA CLARA LAB
10 meetings: Thursdays, 6–9 pm,
February 9–April 12.
Fee: $960 ($864 through Jan. 26).
To enroll, use Section Number 1500.(050)

Linux Based Web Application Development—Apache, MySQL, PHP

For course description, see page 8.

Perl Programming I

For course description, see page 14.

Perl Programming II

For course description, see page 14.

PHP (Hypertext Preprocessor)

X400.491 CMPS (2.0 quarter units)

PHP is one of the best server-side technologies for handling Web content. It is used by millions of sites worldwide. This course starts by covering the development environment, language syntax and programming constructs. It introduces the concepts of OOP in PHP at different levels. It also covers the interactions with HTML Web pages and databases. PEAR (PHP repository) and unit tests are included as advanced topics. Practical examples and sample codes will be given. Students will gain hands-on experience with PHP and learn how to process data to create interactive and dynamic Web pages.

Prerequisite(s): Familiarity with basic programming constructs (of a language such as C or Perl) and a working knowledge of HTML and SQL fundamentals.

MIN WU, Ph.D.

ONLINE, January 9–April 23.
Fee: $770 ($693 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 21343.(025)

SANTA CLARA LAB
8 meetings: Fridays, 6:30–9:30 pm, February 3–March 23.
Fee: $770 ($693 through Jan. 20).
To enroll, use Section Number 21343.(027)

ONLINE, March 5–June 18.
Fee: $770 ($693 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 21343.(026)

Programming for Cloud Computing: Amazon Web Services

X400.555 CMPS (1.5 quarter units)

Amazon Web Services (AWS) is the leading Infrastructure-as-a-Service (IaaS) cloud provider. This course will start with a brief overview of Cloud computing that focuses on IaaS. Discussions will address the various AWS compute, storage, database, networking, messaging, monitoring, and deployment services as well as APIs including: EC2, Auto-Scaling, EBS, S3, SimpleDB, RDS, ElastiCache, Load Balancing, VPC, SQS, SNS, SES, CloudWatch, and Beanstalk. You will gain hands-on experience through a class project that involves designing, coding, and deploying a cloud-focused tool or application. This course covers the concepts and programming techniques used by both IT professionals and application developers.

Prerequisite(s): Experience developing programs in either Python, Perl, Java, C# or Ruby. "Cloud Computing, Introduction" is recommended.

JEFF MILLER, B.S.C.S.

SANTA CLARA CLASSROOM
6 meetings: Wednesdays, 6:30–9:30 pm,
January 25–February 29.
Fee: $650 ($585 through Jan. 11).
To enroll, use Section Number 23094.(004)

Programming with Java for Beginners

For course description, see page 15.

Python Programming for Beginners

For course description, see page 15.

Python for Programmers

For course description, see page 15.

Ruby, Introduction

X400.487 CMPS (0.5 quarter unit)

Ruby is a dynamically-typed, object-oriented programming language which has recently experienced a surge in interest because the popular Rails web programming framework is written in Ruby. It can be used for command scripts, system administration, text processing, GUI programs, networked and distributed applications, and web development. Ruby works well with Test-Driven Development and Agile Methodologies. This course is an introduction to Ruby and will provide a solid foundation for further study. Programming with a dynamic language is different and we'll try to jump-start your learning by emphasizing material not easily found elsewhere.

Prerequisite(s): Familiarity with at least one object-oriented programming language (Java, C#, C, C++, etc.)

WAYNE VUCENIC, B.S.

SANTA CLARA LAB
Saturday, 9 am–4 pm, March 24.
Fee: $255 ($229.5 through Mar. 10).
To enroll, use Section Number 21341.(026)

Ruby and Ruby on Rails, Advanced

X400.489 CMPS (2.0 quarter units)

Ruby on Rails is a popular framework for creating dynamic Web 2.0 database applications. It delivers working, bare-bones Web applications out of the box, ready to be developed into your application. The focus is on the three main topics: Active Record for database persistence, Action Controller for HTTP request routing and processing, and Action View for Web page and form generation. The course also covers configuration, debugging, testing, performance, Ajax on Rails, RESTful architecture, and other advanced topics.

Prerequisite(s): "Introduction to Ruby" or equivalent knowledge, and 1–2 years of object-oriented programming experience. Understanding of technologies such as the HTTP protocol, HTML, CSS, JavaScript, and SQL will enhance your ability to learn Rails.

MIN WU, Ph.D.

ONLINE, January 9–April 23.
Fee: $760 ($684 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 21342.(014)

ONLINE, March 5–June 18.
Fee: $760 ($684 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 21342.(015)

Free Program Overview

Software Development

For event description, see page 13.

SANTA CLARA CLASSROOM
Wednesday, 6–8:30 pm, January 11.
Fee: No fee, but enrollment required.
To enroll, use Section Number 3085.(019)

Web Application Development with Groovy and Grails

X400.565 CMPS (2.0 quarter units)

Groovy and Grails are the emerging Web development language and framework for the Java platform. The first part of this course introduces the dynamic language features of Groovy, including the basic syntax, data types, and control structures. It then goes into more advanced features such as closures, GDK, and meta programming. The second part covers the major components of the Grails framework for Web development, including controller, view, GSP (Grails Server Pages), and AJAX support. Students learn the powerful and high-productivity features of the framework for Web application development.

Prerequisite(s): "Java Programming, Comprehensive," or "Enterprise Solutions Using Java EE," or equivalent experience

HIEN LUU, M.S.

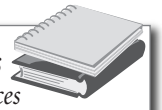
SANTA CLARA LAB
8 meetings: Tuesdays, 6:30–9:30 pm,
February 21–April 10.
Fee: $760 ($684 through Feb. 7).
To enroll, use Section Number 23390.(002)

Web Technologies, Introduction

For course description, see page 26.

XML Essentials

For course description, see page 15.



Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, **Content Management Corporation (CMC)**
- Electronic course materials from our online learning platform, **UCSC Extension Online**
- Textbooks (required and recommended). Purchasing information can be found at: **ucsc-extension.edu/bookstore.**
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to **ucsc-extension.edu/course-materials.**

Certificate Program

Software Engineering and Quality

The Software Engineering and Quality Certificate Program combines three previous certificate programs from UCSC Extension: Software Engineering, Software Quality and Engineering Management, and Software Engineering Management. The courses you have taken before in any of these three programs can all apply toward the certificate. The certificate program includes three specialized tracks which share many courses of common interest.

CERTIFICATE CONTACT

Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW

Our new comprehensive curriculum in Software Engineering and Quality combines foundation-level course work in software engineering with cutting-edge developments in software quality, testing and software project management. The software engineering track covers the architecture and development process.
The quality and testing track includes courses in state-of-the-art testing strategies and methods. The software management track addresses the practices and skills needed to manage software projects. We've also added programming refresher courses as electives for managers and SQA professionals.

CERTIFICATE REQUIREMENTS

To obtain the Certificate in Software Engineering and Quality, you must complete a minimum total of **14 units** which must include **one of three core courses**. For additional requirements, go to ucsc-extension.edu.

PREREQUISITES

A degree in computer science or engineering, or equivalent experience in software development, testing, QA or project management is required.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Only one course may be shared between two Engineering and Technology certificate programs unless otherwise noted.

Courses

Agile Software Development

X400.461 CMPS (0.5 quarter unit)

Agile methodologies are changing the way software developers work. This course will equip you with the concepts, methods, practices, and tools needed to use Agile in software development. It covers common Agile practices including extreme programming, pair programming, feature driven development, test driven development, continuous integration, code refactoring, and more. You will also learn how Agile can be applied to larger projects. To experience the real world use of Agile, there will be a laboratory session that simulates an Agile project.

Prerequisite(s): A degree in computer science or engineering or equivalent experience in software development, testing, QA or project management.

KAREN MACKEY, Ph.D.
SUSAN MICKEL, M.S., M.B.A.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
4 meetings: Thursdays, 6:30–9:30 pm, January 26–February 9; Saturday, 9 am–3:30 pm, February 11.
Fee: $650 ($585 through Jan. 12).
To enroll, use Section Number 20285.(003)

C Programming for Beginners

For course description, see page 12.

C# .NET Programming, Comprehensive

For course description, see page 13.

Enterprise Application Performance Management (APM) for Java EE and .NET Platforms

For course description, see page 18.

JUnit Test Framework

X460.8 CMPS (1.5 quarter units)

JUnit is one of the most popular open source testing frameworks for all types of Java software applications at the unit, integration, functional, and acceptance testing stages of the software life cycle. This course begins with the fundamentals of JUnit, including installation, setup and integration with Eclipse and Apache Ant, two of the major Integrated Development Environments (IDE) that support JUnit. Then the features of JUnit are covered, along with how different versions compare to each other, and how to customize JUnit and create automated tests.

Students will learn the real-world uses of JUnit, including test strategies and the concept of Test Driven Development (TDD) also known as "test first, code later." Other advanced topics include testing presentation layer, server side, JPA and database access. By the end of this course, students will have learned to use JUnit to test Java applications in all life cycle stages and will be able to apply this framework to build automation testing.

Prerequisite(s): "Programming with Java for Beginners" or equivalent Java experience.

AHMAD NOURI, M.S.

ONLINE, March 5–June 18.
Fee: $650 ($585 through Feb. 20).
Enrollment accepted through February 13.
To enroll, use Section Number 6198.(009)

SOFTWARE ENGINEERING AND QUALITY CERTIFICATE

14-unit minimum

*Choose one of these three core courses	Units	Course	F	W	Sp	Su
Software Engineering						
* Object-Oriented Analysis and Design	3.0	0774	❍	❒	❍	❒
Object-Oriented Development:						
Architectures and Design Patterns, Advanced	3.0	6633		■		■
Refactoring with Design Patterns	1.5	6427			■	
Enterprise Application Performance Management (APM) for Java EE and .NET Platforms	1.5	4412		■		■
Data Structures and Algorithms using C++	3.0	4732	■		■	
Software QA and Testing						
* Software Quality Assurance and Testing	2.0	3396		■		■
Software Testing: Techniques, Tools and Practices	3.0	20501		■		■
JUnit Test Framework	1.5	6198	❒	❍	❒	❍
Professional Software Practices						
* Professional Software Development Fundamentals	3.0	22868	■		■	
User Research: User Needs and Usability Assessment	2.0	20079		■		
User Experience Design for Web Applications	2.0	3113	■		■	
Agile Software Development	1.5	20285		■	■	
Managing Software Projects	1.5	0943	■		■	
Refresher for Software Professionals						
Programming with Java for Beginners	1.5	5185	❒	❍	❒	❍
C# .NET Programming, Comprehensive	3.0	5408	■	❍	■	❍
C Programming for Beginners	3.0	5208	❒	❒	❒	❒
Perl Programming I	2.0	2856	■	■	■	■
Python Programming for Beginners	1.5	20776	■	■	■	■
Ruby, Introduction	0.5	21341	■	■	■	■
Relational Database Essentials	3.0	6195	❒	❒	❒	❒

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Object-Oriented Analysis and Design

X431.2 CMPS (3.0 quarter units)

Object-oriented design involves transforming the descriptive analysis models into computational models for coding. During an object-oriented analysis, a descriptive model of the problem domain is developed. Instruction uses the notation specified by the Unified Modeling Language (UML). Students will learn Agile and Iterative Development methodologies and use case design and requirements driven design. The course covers the principles of object-oriented design as well as practical considerations for applying these principles. Methods for evaluating and fixing poor designs are also addressed, as well as tools and library issues.

Prerequisite(s): Programming experience in an object-oriented language. e.g. Java, C++, Python, etc.

EDWIN MACH, M.S.

ONLINE, January 9–April 23.
Fee: $1020 ($918 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 0774.(053)

ONLINE, March 5–June 18.
Fee: $1020 ($918 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 0774.(054)

GITU JAIN, Ph.D.

SANTA CLARA CLASSROOM
10 meetings: Saturdays, 9 am–12 pm,
January 21–March 31 (no meeting Feb. 18).
Fee: $1020 ($918 through Jan. 7).
To enroll, use Section Number 0774.(055)

Object-Oriented Development: Architectures and Design Patterns, Advanced

X470.9 CMPS (3.0 quarter units)

This course begins with a discussion of best practices in software architecture and detailed design. Covered next are a wide range of design patterns used to construct modern software systems- patterns which are an integral part of a designer's engineering toolkit. The course illustrates the reuse of design patterns with an overview of patterns from the gang of four and several domains including refactoring, performance, distribution, lifecycle management, system integration, and message routing. The course concludes with lectures on object-oriented framework design, software product lines, software components, and an overview of aspect-oriented programming.

Prerequisite(s): Knowledge of object-oriented development; including UML notation, and familiarity with an object-oriented language such as C++ or Java.

STEVEN FONSECA, Ph.D.

SANTA CLARA CLASSROOM
6 meetings: Saturdays, 9 am–3 pm, March 10–April 14.
Fee: $1020 ($918 through Feb. 25).
To enroll, use Section Number 6633.(025)

Perl Programming I

For course description, see page 14.

Programming with Java for Beginners

For course description, see page 15.

Python Programming for Beginners

For course description, see page 15.

Relational Database Essentials

For course description, see page 16.

Ruby, Introduction

For course description, see page 19.

Software Quality Assurance and Testing

X418.1 CMPS (2.0 quarter units)

As the software industry evolves, the need for qualified engineers trained in the principles, methodologies, techniques, and tools of software quality assurance has grown. This course presents the specifics of software quality assurance and software testing. The course also describes how these processes fit into the software development process. Topics include process and product quality; building an effective SQA organization; techniques and content of an SQA plan; software quality standards; overview of test cycles; test planning; software inspections; basic concepts of measurement; software development, Total Quality Management, and risk management.

ALKA JARVIS, M.B.A.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
7 meetings: Tuesdays, 6:30–9:30 pm,
February 7–March 20.
Fee: $735 ($661.50 through Jan. 24).
To enroll, use Section Number 3396.(046)

Software Testing: Techniques, Tools and Practices

X400.435 CMPS (3.0 quarter units)

This course covers the fundamentals of software testing with an emphasis on test techniques, test tools, and testing practices. For the various phases of software development, the course introduces testing strategies, or test levels. Open source and commercially available tools will be used to demonstrate concepts such as test generation and test coverage. Students gain hands-on testing and analysis experience with sample code using state-of-the-art software analysis and testing tools.

Prerequisite(s): Some knowledge of C++ or Java would be helpful.

BOB PRINTIS, Ph.D.

SANTA CLARA LAB
10 meetings: Fridays, 6:30–9:30 pm,
January 20–March 23.
Fee: $735 ($661.50 through Jan 8).
To enroll, use Section Number 20501.(011)

Free Program Overview

Software Development

For event description, see page 13.

SANTA CLARA CLASSROOM
Wednesday, 6–8:30 pm, January 11.
Fee: No fee, but enrollment required.
To enroll, use Section Number 3085.(019)

User Research: User Needs and Usability Assessment for Web and Software Products

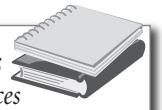
X400.409 CMPS (2.0 quarter units)

It is commonly reported that more than 60 percent of rework in software products results from problems related to not understanding what users need! In this project-based class, students will learn how to make products more usable through a user-centered design (UCD) process. The instructor will provide real-life industry examples of applying UCD methods to software and Web projects. Topics include business scenarios, user profiles and user task analysis; inquiry methods, including contextual inquiry, focus groups, interviews and surveys; and assessment methods, including usability testing, heuristic evaluations, and inspections.

Prerequisite(s): An understanding of the software development or Web design process is required. All students will need to have access to the Internet at home or work.

ALICE CHIANG, Ph.D.

SANTA CLARA CLASSROOM
8 meetings: Wednesdays, 6:30—9:30 pm,
February 29–April 18.
Fee: $875 ($787.50 through Feb. 15).
To enroll, use Section Number 20079.(009)



Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, **Content Management Corporation (CMC)**
- Electronic course materials from our online learning platform, **UCSC Extension Online**
- Textbooks (required and recommended). Purchasing information can be found at: **ucsc-extension.edu/bookstore.**
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to **ucsc-extension.edu/course-materials.**

Technology Management

Extension's Engineering Management Program is one of the few training programs in the Bay Area designed specifically for engineers, project managers and other technology professionals interested in information and knowledge management in high-tech enterprises. With a specialized program in Knowledge Services and Enterprise Management (KSEM), we provide a new interdisciplinary graduate certificate program to address the challenges in today's global and knowledge-based economy. More information and technology management courses will be added in the coming quarters.

Certificate Program

Knowledge Services and Enterprise Management (KSEM)

CERTIFICATE CONTACT
UCSC Baskin School of Engineering: (408) 919-8902, or spabst@soe.ucsc.edu.

PROGRAM OVERVIEW
Knowledge Services and Enterprise Management (KSEM) is a UCSC Extension graduate-level certificate program designed and developed by the Technology and Information Management faculty of the UCSC School of Engineering in consultation with UCSC Extension.

KSEM is a new interdisciplinary field, studying the application of information technology and knowledge services to the management of high-tech enterprises and other complex systems.

The KSEM Certificate Program is designed to prepare graduates for careers in the areas of:

- Data mining and data analytics
- Information retrieval and knowledge management
- Business, service and call center analytics
- New product and service development
- Management of technology
- Project planning and risk management
- Portfolio management (products and services)
- Service management and e-business
- Ad optimization and Web marketing
- Global supply and value change management
- Manufacturing and outsourcing

CERTIFICATE REQUIREMENTS
To obtain the Certificate in Knowledge Services and Enterprise Management, you must complete a minimum of **20 units**, including **two of the four core courses**. Any remaining unit requirements may be satisfied by taking elective courses.

PREREQUISITES
Training in the basics of statistics, stochastic process and other algorithmic approaches (i.e., "CE 107: Introduction to Stochastic Methods of System Analysis") is required.

For more information, see soe.ucsc.edu/programs/ksem.

KNOWLEDGE SERVICES AND ENTERPRISE MANAGEMENT CERTIFICATE

20-unit minimum

CORE COURSES (choose two)	Units	Course	F	W	Sp	Su
Data Mining	5.0	20294			■	
Information Retrieval	5.0	20326				
E-Business Technology and Strategy	5.0	20325				
Knowledge Services and Data Analytics	5.0	20034	■			

ELECTIVE COURSES	Units	Course	F	W	Sp	Su
Advanced Topics in TIM	5.0	23587	■			
Financial Engineering and Management in High Technology Firms	5.0	22752o			■	
Management of Technology I: Management, Development and Commercialization (MDC) of New Products and Technologies	5.0	20022	■			
Management of Technology II: Supply Chain Management	5.0	22630		■		
Large-Scale Web Analytics and Machine Learning	5.0	30003		■		
Random Process Models in Engineering	5.0	30005			■	
Services Engineering and Management	5.0	20295			■	
Stochastic Optimization in Information Systems and Technology Management	5.0	20842				
Data Warehouse Solutions and Business Intelligence	2.0	3502	■		■	
Machine Learning and Data Mining, Introduction	3.0	2612	■	■		
Management and Organization, Principles	2.0	0692	■		■	

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Courses

Large-Scale Web Analytics and Machine Learning

XSC251 TIM (5.0 quarter units)

This course provides a systematic methodology for Web Analytics and Machine Learning and a corresponding set of methods and analytical tools, including stochastic models, reinforcement learning, stochastic (neuro-)dynamic programming, Bayesian Graphical models, inference, and social networks. The methods can be used to achieve business intelligence, and support research and applications in computer science, computer engineering, electrical engineering, applied mathematics and statistics, business, management, and economics. The course includes exposure to Hadoop for large scale computation.

Prerequisite(s): A solid background in probability encompassing statistics, stochastic methods, calculus, and preferably stochastic processes and optimization, or mathematical maturity and exposure to business intelligence and algorithms.

INSTRUCTOR: TBA.

SANTA CLARA CLASSROOM
10 meetings: Mondays, 6–9:30 pm,
January 9–March 19 (no meetings Jan. 16 and Feb. 20).
Fee: $1020 ($918 through Dec. 20).
To enroll, use Section Number 30003.(001)

Machine Learning and Data Mining, Introduction

For course description, see page 14.

Management of Technology II: Supply Chain Management

XSC225 TIM (5.0 quarter units)

Supply Chain Management (SCM) focuses on the design of the supply chain network, which involves suppliers, manufacturers, distributors, and retailers, all the way to the end-customer. This course develops and applies methods and tools that integrate the management, strategy, planning, and operation of supply chain networks. These tools include demand forecasting, inventory management, resource allocation, network and facilities design, and information systems design. Case studies will be used to demonstrate the application of these methods and tools developed in companies such as Dell, Toyota and Wal-Mart.

Prerequisite(s): "Management of Technology I" or consent of instructor.

SUBHAS DESA, Ph.D.

SANTA CLARA CLASSROOM
10 meetings: Wednesdays, 6–9:30 pm,
January 11–March 21.
Fee: $1020 ($918 through Dec. 21). Students may enroll any time up to the third meeting: Jan. 18.
To enroll, use Section Number 22630.(003)

Web and Graphic Design

Our Silicon Valley-based Web and graphic design courses are taught by working professionals and cover a wide range of design, business and technical subjects relevant to these fields. To keep current with these dynamic industries, we frequently review and update our courses. We offer a full range of hands-on software application training courses including Adobe Photoshop, Illustrator, Flash and Dreamweaver. Our design courses include graphic design fundamentals, graphic design for the Web, user-centered design, and designing with various technologies. Our technical courses cover programming skills such as HTML/XHTML, JavaScript, and cascading style sheets (CSS).

Graphic Design

Whether you're designing Web sites, developing mobile apps or deploying a marketing campaign, good graphic design skills and familiarity with the leading graphics tools are essential for Silicon Valley professionals. Our graphic design courses are ideal if you're looking for foundation skills or want to learn the latest versions of these tools.

Adobe Photoshop, Introduction

X499.16 ART (1.0 quarter unit)

This course introduces the basics of Photoshop CS5, the industry standard for the creation and manipulation of digital images. The course is designed for beginners and taught with lectures, demonstrations, hands-on work, critiquing and troubleshooting in a lab setting. Students are introduced to the Photoshop interface and its dense menu options. They learn to use the tools for basic image editing, photo retouching, painting, creating composite images and working with type. Students also learn basic color theory, workflow methodology and best practices.

Prerequisite(s): Familiarity with the Mac and/or Windows environment.

RENATE ELHARDT.

SANTA CLARA LAB
6 meetings: Wednesdays, 6:30–9:30 pm,
January 18–February 22.
Fee: $550 ($495 through Jan. 4).
To enroll, use Section Number 5307.(140)

Certificate Program

Web Design and Development

CERTIFICATE CONTACT
Engineering and Technology Department, (408) 861-3860, or e-mail program@ucsc-extension.edu.

PROGRAM OVERVIEW
Designing a successful Web site involves understanding business needs, who the end-users will be, and what is technically possible. It starts with knowing the Web design process and the technical landscape. Web designers need to know how to define the business problem, determine user needs, and apply principles of information architecture, interaction design, graphic design, and user research. They also need to know how to write their own front-end code and use visual authoring software. Our certificate program offers both foundation-level and advanced Web design courses. Those who are new to the Web Design field should start with the recommended prerequisites and take all the foundation courses. This will equip you with the broad, solid skills needed to become a competent Web designer. Experienced Web designers who want to extend and expand their skill set can take a mix of foundation and advanced courses based on current knowledge and individual career goals. Either approach leads to a UC certificate.

CERTIFICATE REQUIREMENTS
To obtain the Certificate in Web Design, you must complete a minimum of **17.5 units**. Certificates are granted upon successful completion of "Web Design Project." For students new to the Web Design field, we strongly recommended: "Web Design, Introduction" and all eight other foundation courses. For those with two or more years of industry experience who are proficient in some Web design skills, foundation courses can be taken, as needed, to round out your skill set and to supplement the advanced courses. For additional information, go to ucsc-extension.edu/web-design.

PREREQUISITES
There are no formal prerequisites to enter the certificate program. However, students should be proficient in Adobe Illustrator and Adobe Photoshop. For those in need of these skills, we offer introductory courses in Adobe Illustrator and Adobe Photoshop. These two recommended prerequisites do not count toward the total number of units required for the certificate and may be satisfied with equivalent experience. We also recommend "Graphic Design Fundamentals" as a prerequisite for students who do not have previous graphic design background.

RECOMMENDED COURSE SEQUENCE
Depending on your level of experience, the courses may be taken in any order, provided the individual course prerequisites have been fulfilled. All students should end with "Web Design Project." For more information, visit ucsc-extension.edu/web-design. New students should attend the Program Overview or Open House events to receive course sequence information.

PROGRAM COORDINATOR
LILLIAN SVEC, M.F.A., has championed user-centered design and information architecture (IA) on the Web for more than 15 years. She pioneered the IA role at Studio Archetype. At Sapient, she was the Global Practice Lead for IA, providing leadership to 100 team members in eighteen offices worldwide. At Walmart.com, she was the Director of User Experience.

Free Program Overview

Web Design Program Overview with Dreamweaver CS5 Preview

Learn about our courses and program philosophy, see student work, and have an opportunity for Q & A. In the first half of the event we will present program overview, new course highlights, and recommended course sequence. We will also discuss job opportunities in the Web Design field. In the second half, get a taste of one of our popular software classes through Adobe Dreamweaver CS 5 Preview. Dreamweaver has become the industry standard for quickly and efficiently building sophisticated interactive Web sites. This seminar provides an overview of working in Dreamweaver and meet with instructors in our state-of-the-art Mac Lab, and see the learning environment for yourself.

AUDREY BLUMENEAU, M.Ed.
LILLIAN SVEC, M.F.A.
ANDY HOU.

SANTA CLARA CLASSROOM
Monday, 7–9 pm, January 9.
Fee: No fee, but enrollment required.
To enroll, use Section Number 6667.(008)

FOR INFORMATION ON CERTIFICATE APPLICATIONS AND TRANSFERRING CREDIT FROM OTHER SCHOOLS, GO TO UCSC-EXTENSION.EDU.

Recommended Prerequisite

Adobe Photoshop, Introduction

For course description, see left column.

Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

WEB DESIGN CERTIFICATE

17.5-unit minimum

RECOMMENDED PREREQUISITE COURSES	Units	Course	F	W	Sp	Su
Adobe Illustrator, Introduction*	1.5	6497	■		■	
Adobe Photoshop, Introduction*	1.5	5307		■		■
Graphic Design Fundamentals	2.0	20025	■		■	

* The Illustrator and Photoshop Introduction courses may not be applied toward the Certificate, however, students may apply "Graphic Design Fundamentals" as an elective.

FOUNDATION COURSES	Units	Course	F	W	Sp	Su
Design Basics						
Web Design, Introduction	0.5	22609	■		■	
User Experience Design Fundamentals for the Web	2.0	0087	■		■	
Visual Design for the Web	2.5	18977		■		■
Production and Animation						
Graphical Production for the Web	1.5	1262	■		■	
Adobe Flash I—Animation for the Web	1.5	1107	■	■	■	■
Technical Implementation						
Web Technologies, Introduction	1.0	22623		■		■
HTML/XHTML: Building Blocks for Web Development	2.0	20816	❍	❒	❍	❒
Designing with Cascading Style Sheets I	1.5	6673	❍	■	❍	■
Adobe Dreamweaver—Client Side	2.0	2212	■		■	

ADVANCED COURSES	Units	Course	F	W	Sp	Su
User Experience Design						
User Research: User Needs and Usability Assessment for Web and Software Products	2.0	20079		■		
User Experience Design for Web Applications	2.0	3113	■		■	
Advanced Implementation						
JavaScript for Designers	1.0	1879				■
Designing with Cascading Style Sheets II	1.0	21317		■		■
Adobe Flash II—Basic ActionScript Programming for the Web	1.5	5496		■		■
Site and Content Management						
Managing Website Development and Deployment	1.0	4313	■		■	
Web Content Management Systems: Drupal and Wordpress, Introduction	2.0	22627		■		■

REQUIRED COURSE	Units	Course	F	W	Sp	Su
Web Design Project	2.0	5228		■		■

ALSO OF INTEREST*	Units	Course	F	W	Sp	Su
Internet Programming and Development						
PHP (Hypertext Preprocessor)	2.0	21343	❒	❒	❒	❒
XML Essentials	2.0	3279	❍	❍	❍	❍
Javascript and AJAX, Comprehensive	3.0	1500		■		■
Digital Marketing						
Search Engine Optimization	2.0	19966			■	
Web Writing that Works	1.5	23091	❍			
Web 2.0: Social Media Marketing	2.0	19357			❍	

* One "Also of Interest" course may be applied towards the Certificate

■ held in classroom ❍ offered online ❒ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Required Course

Web Design Project

X402.7 FILM (2.0 quarter units)

This course provides the opportunity to complete the entire process of developing a Web site for an actual client of the student's own choosing, including the processes of needs analysis, design and deployment. This is the last course in the Web Design Certificate program, and students are expected to demonstrate the range of skills and knowledge they have acquired. The project involves information architecture, interface design, visual design, XHTML, CSS, cross browser compatibility and basic JavaScript. Complementary topics such as CGI scripts, CMS and mobile devices are also introduced.

Prerequisite(s): "Graphic Design Principles for the Web," "Graphical Production for the Web," "HTML/XHTML: Building Blocks for Web Development," "Designing with CSS I," "Adobe Dreamweaver: Client Side" or equivalent experience with instructor approval. All Web Design foundation courses or equivalent experience is recommended.

LORI NEUMANN, B.A.
MICHAEL J. BASHISTA, M.Ed.

SANTA CLARA LAB
8 meetings: Fridays, 6–9 pm, February 3–April 20
(no meetings Feb. 24, Mar. 16, 30 and April 6).
Fee: $720 ($648 through Jan. 20).
To enroll, use Section Number 5228.(024)

Elective Courses

Adobe Flash—Animation for the Web

X403.3 FILM (1.5 quarter units)

Adobe's Flash CS5 is a powerful application for creating content for the Web, mobile devices, CDs, videos and stand-alone desktop applications. This course explores the rich animation capabilities of Flash. Learning how to import Photoshop and Illustrator files will expand your resources. You'll also learn to build objects using the Flash toolset, employing key frame animation to create 2D and 3D effects, motion, masking and 3D rotation. The final project is a timeline-based Web site using basic ActionScript, Flash's programming language.

Prerequisite(s): Hands-on working knowledge of the Macintosh and/or Windows environment.

MICHAEL J. BASHISTA, M.Ed.

SANTA CLARA LAB
5 meetings: Tuesdays, 6:30–9:30 pm,
January 31–February 28.
Fee: $550 ($495 through Jan. 17).
To enroll, use Section Number 1107.(046)

ACCESS TO ONLINE RESOURCES

WEB COMPONENT indicates that classroom instruction is supplemented with online materials or activities. Students enrolling in one of these courses for the first time will receive an e-mail with logon information within 24 hours. However, access to course resources may not be active until one day prior to the course's start date.

Adobe Flash II—Basic ActionScript Programming for the Web

X401.8 FILM (1.5 quarter units)

This course covers the Flash ActionScript fundamentals used to build dynamic, responsive features into your Web sites. The course is for designers who lack a background in programming. It begins with the concept of "pathing," in which messages are sent between objects on your stage. The programming concepts of variables and conditional statements are introduced with the creation of a toggle button. You'll learn how to load and control external sounds, images, video and other Flash movies. The course concludes by introducing the available pre-build components, and incorporates many of these into a final project.

Prerequisite(s): "Adobe Flash I - Animation for the Web" or an equivalent course. Students must be familiar with the Flash CS5 interface and be able to build animations.

MICHAEL J. BASHISTA, M.Ed.

SANTA CLARA LAB
5 meetings: Tuesdays, 6:30–9:30 pm, March 13–April 10.
Fee: $550 ($495 through Feb. 28).
To enroll, use Section Number 5496.(060)

Designing with Cascading Style Sheets (CSS) I

X406.4 FILM (1.5 quarter units)

Cascading style sheets (CSS) are a mandatory method for a Web designer to control the look and feel of a modern Web site. Combined with proper HTML markup, CSS allows for precise control over a Web page's appearance without the use of tables. This beginning course will provide demonstrations and hands-on exercises covering the application and syntax of CSS; hand-coding CSS properties for font, text formatting and backgrounds; the box model; creating vertical and horizontal navigation menus and two and three column page-layouts.

Prerequisite(s): "HTML/XHTML: Building Blocks for Web Development" or equivalent experience with instructor approval.

AUDREY BLUMENEAU, M.Ed.

SANTA CLARA LAB
3 meetings: Saturdays, 10 am–5 pm, February 4–25.
Fee: $550 ($495 through Jan. 21).
To enroll, use Section Number 6673.(023)

Designing with Cascading Style Sheets (CSS) II

X400.477 CMPS (1.0 quarter unit)

Today's browsers support a wide range of Cascading Style Sheets (CSS) Level 2.1 and now CSS Level 3 properties. CSS is considered a mandatory language for any Web designer in today's industry. This course provides lecture and hands-on exercises covering various properties, such as styling survey forms and creating layouts for image galleries with captions. It also covers some of the new capabilities that CSS Level 3 provides including opacity, rounded corners (border-radius), text-shadowing, structural pseudo-classes and more.

Prerequisite(s): "HTML/XHTML: Building Blocks for Web Development" and "Designing with Cascading Style Sheets (CSS) I," or equivalent experience with instructor approval.

AUDREY BLUMENEAU, M.Ed.

SANTA CLARA LAB
2 meetings: Saturdays, 9 am–4 pm, March 10–17.
Fee: $520 ($468 through Feb. 25).
To enroll, use Section Number 21317.(008)

Visual Design for the Web

X400.286 ART (2.5 quarter units)

In this course, we will discuss the role of graphic design in the overall Web-design process, focus on the guiding principles and key aspects of graphic design, and examine how they apply to the Web. Students will be asked to create graphic design layouts for a Web site starting with the information architecture. Topics include using color, typography, layout and imagery; communicating the brand; creating a visual system; making it user friendly; presenting your design concepts; setting up your files; and introduction to graphic production for the Web. Students will acquire knowledge that will help them create more appealing and usable Web sites.

Prerequisite(s): "Adobe Photoshop, Introduction" and "Adobe Illustrator, Introduction" or equivalent experience with instructor approval. "Graphic Design Fundamentals" is highly recommended. Web Design Certificate students should take "User-Centered Design Fundamentals for the Web" first.

LORI NEUMANN, B.A.

SANTA CLARA LAB
9 meetings: Thursdays, 6:30–9:30 pm,
February 2–March 29.
Fee: $690 ($621 through Jan 19).
To enroll, use Section Number 18977.(014)

HTML/XHTML: Building Blocks for Web Development

X400.467 CMPS (2.0 quarter units)

In this hands-on course, students learn to code Hypertext Markup Language (HTML) and Extensible Hypertext Markup Language (XHTML) as specified by the W3C, the official Web standards body. The course also examines ways in which HTML5, a new version of HTML currently under development, is poised to change the current standards. This course is for students who have not coded Web pages before and it can serve as a review for students who have some HTML coding knowledge and want to build on that knowledge as the foundation for learning XHTML or HTML5.

Prerequisite(s): Working knowledge of standard text editors like SimpleText, NotePad, WordPad, or BBEdit. Basic Web-development concepts are recommended.

AUDREY BLUMENEAU, M.Ed.

ONLINE, January 9–April 23.
Fee: $640 ($576 through Dec. 26).
Enrollment accepted through February 13.
To enroll, use Section Number 20816.(022)

SANTA CLARA LAB
4 meetings: Wednesdays, 1–6 pm; Saturdays, 10:30 am–4:30 pm, January 18–28.
Fee: $640 ($576 through Jan. 4).
Enrollment accepted through February 13.
To enroll, use Section Number 20816.(024)

ONLINE, March 5–June 18.
Fee: $640 ($576 through Feb. 20).
Enrollment accepted through April 9.
To enroll, use Section Number 20816.(023)

Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, Content Management Corporation (CMC)
- Electronic course materials from our online learning platform, UCSC Extension Online
- Textbooks (required and recommended). Purchasing information can be found at: ucsc-extension.edu/bookstore.
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to ucsc-extension.edu/course-materials.

User Research: User Needs and Usability Assessment for Web and Software Products

For course description, see page 21.

Web Content Management Systems: Drupal and Wordpress, Introduction

X400.542 CMPS (2.0 quarter units)

This course focuses on the two most popular open-source content management systems: Drupal and Wordpress. Discussions address real-life use cases and guide students through the planning and implementation phases of setting up a CMS-driven Web site. Via hands-on exercises and assignments, students learn how to install, configure, and customize Drupal and Wordpress sites. Topics include best practices and troubleshooting common problems. Upon completing the course, students are prepared to use Drupal and Wordpress to build state of the art Web sites.

Prerequisite(s): "HTML/XHTML: Building Blocks for Web Development" and "Designing with Cascading Style Sheets I," or equivalent knowledge. "Managing Web Site Development and Deployment," and "Graphical Production for the Web" are recommended.

VICKI WINTERS, M.A.

SANTA CLARA LAB
7 meetings: Mondays, 6:30–9:30 pm,
January 23–March 12 (no meeting Feb. 20).
Fee: $580 ($522 through Jan. 9).
To enroll, use Section Number 22627.(005)

Web Technologies, Introduction

X400.536 CMPS (1.0 quarter unit)

This course explores the fundamental capabilities of key Web technologies without delving into programming. The course begins with Internet fundamentals including HTML basics, Cascading Style Sheets (CSS), and Extensible Markup Language (XML), and describes how scripting, such as JavaScript, Perl, or AJAX, works in dynamic Web sites. The course also touches on Web and application servers, including the Common Gateway Interface (CGI), Hypertext Preprocessor (PHP) and Content Management Systems. Additional discussions address e-commerce, databases, social networking, and cloud computing.

Prerequisite(s): Experience using the Web and browsers, basic knowledge of HTML. Web Design Certificate students should first take "HTML/XHTML 101: Building Blocks for Web Development."

TERRI FITZMAURICE, B.A.

SANTA CLARA CLASSROOM WITH A WEB COMPONENT
4 meetings: Mondays, 6:30–9:30 pm, March 19–April 9.
Fee: $550 ($495 through Mar. 5).
To enroll, use Section Number 22623.(005)

Also of Interest

JavaScript and AJAX, Comprehensive

For course description, see page 18.

PHP (Hypertext Preprocessor)

For course description, see page 19.

XML Essentials

For course description, see page 15.

ACCESS TO ONLINE RESOURCES

WEB COMPONENT indicates that classroom instruction is supplemented with online materials or activities. Students enrolling in one of these courses for the first time will receive an e-mail with logon information within 24 hours. However, access to course resources may not be active until one day prior to the course's start date.

Course Readers, Textbooks and Other Instructional Resources

Students are responsible for obtaining the required instructional materials for all courses. A variety of media may be used. Please review the section details at the bottom of the course description pages on our Web site.

Instructors may specify any of the following:

- Printed course readers from our on-demand service provider, **Content Management Corporation (CMC)**
- Electronic course materials from our online learning platform, **UCSC Extension Online**
- Textbooks (required and recommended). Purchasing information can be found at: **ucsc-extension.edu/bookstore.**
- Other materials distributed via e-mail either by the Academic Department or the instructor

Students should acquire or access their materials prior to the first class meeting. For full instructions, go to **ucsc-extension.edu/course-materials.**

MAC LAB FOR HANDS-ON LEARNING

UCSC Extension Silicon Valley offers a state-of-the-art Mac Lab, featuring dual-core Mac Pros, flat panel displays, the latest version of Mac OS X, and professional software, including Adobe CS5. This Mac Lab, along with our other PC Labs, provides you with the opportunity to practice new skills while you learn. Instructors can interact with you and answer your questions in class, and help you turn the classroom knowledge to your professional advantage.