

Network Engineering and Systems Security

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 covers 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 both fields. You'll learn how these courses can help you break into new fields, and advance your career.

[Course 20544](#)
[and 22403](#)



ENGINEERING AND TECHNOLOGY



Sophisticated Training for Network Administrators, Engineers, Security Professionals

Computer networks are the global platform on which companies conduct business. 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 regularly updated to reflect the industry's latest developments and practices. Students acquire career-oriented skills and practical knowledge, and many courses include hands-on learning in our labs.

Advanced Study in Network or Security Specializations

The Network Engineering and Systems Security certificate program at UCSC Extension offers courses at several levels. Students who are new to the field or changing careers can find fundamental courses that build essential knowledge in networking, Internet and security. Examples include storage networking, optical networks, wireless technologies and network programming. The certificate program prepares students to succeed as networking and security professionals working in design, application, IT and e-commerce environments.

Preparation for Professional Certification Exams and Careers

The certificate in Network Engineering and Systems Security provides comprehensive courses that help students acquire the knowledge and lab experience needed to obtain various certifications managed by companies or professional societies. Courses go beyond the theory and relevant technologies, providing hands-on lab exercises that equip students to immediately apply new skills in the workplace.

Benefits of Studying at UCSC Extension

- Comprehensive course offerings
- Advanced specializations in networking and security
- Courses taught by expert professionals
- University of California quality reputation
- Convenient course schedules and location

Who Should Attend This Program

This certificate is intended for network and system administrators, IT professionals, network designers and programmers, business security professionals, and others who want to enter the expanding fields of networking or security. Individuals who would like to learn the fundamentals of network management and internet security can also benefit from the certificate program.



About UCSC Extension Silicon Valley

The vital learning community at UCSC Extension Silicon Valley is well known for its collegial atmosphere and rigorous preparation. Our faculty of expert practitioners teaches state-of-the-art solutions to the everyday problems confronting technology professionals working in Silicon Valley. The professional education programs we offer build expertise, open doors to new opportunity, and deliver tangible value. Our broad portfolio of open-enrollment courses and certificates, affordable pricing, experience-based instruction, and central location in Silicon Valley help turn jobs into careers.

Network Engineering and Systems Security Certificate

Certificate Requirements

To obtain the Certificate in Network Engineering and Systems Security, you must complete 14 units, representing 140 hours of instruction.

Total: 14 units

GPA: 3.0 (C or better in all courses).

Prerequisites

Students enrolled in this program are expected to be familiar with Web and Internet infrastructure, and possess basic knowledge of computer networking and communications. Students should be familiar with at least one modern computer operating system. Many of the courses in this program have specific prerequisites that are listed in the course descriptions. For details see full course descriptions at ucsc-extension.edu/engineering.

Recommended Course Sequence

We recommend that you begin with "Computer Networking Essentials" and "TCP/IP Essentials." To gain a solid understanding of the entire industry, students should consider taking all fundamental courses but they are not required. Each advanced course has specific prerequisites that you should consider before enrolling. View full course description for details at: ucsc-extension.edu/engineering.

Program Contact

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



Curriculum

COURSES	Units	Course
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
Storage, Optical, VoIP and System Design		
Network Storage Essentials	3.0	21940
Optical Networks Essentials.....	3.0	3943
Smart Grid, Introduction	1.0	22867
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 [v4.1]	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
Software Security Testing	1.0	20280

Courses

Cloud Computing, Introduction

This course introduces students to the concepts and technologies involved in cloud computing, which refers to scalable and virtualized computing over the Internet. The course begins with surveys of technologies deployed by Amazon, Google, Microsoft, and various academic and open-source providers. It explains how cloud computing services can provide on-demand access to data storage, computing resources, and messaging. It also introduces the enabling technologies: Web 2.0, virtualization, grid and utility computing that comprise the infrastructure behind a cloud computing service. The course examines various case studies and technical-business models.

[Course 22413](#)

Coding Theory and Applications, Introduction

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.

[Course 23389](#)

Comprehensive Signal and Power Integrity for High-Speed Digital Systems

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.

[Course 22874](#)

Course Descriptions

Computer, Network and Internet Security Fundamentals

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, and 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 lectures, labs, examples, and demonstrations of tools and techniques.

Course 4100

Computer Networking Essentials

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.

Course 2458

Cryptography and Network Security

This course provides intensive coverage of the field of cryptography. Students learn how cryptosystems are designed and how to match cryptosystems with the needs of an application. Students also learn basic cryptanalysis and are presented with real life breaches of common cryptosystems to better understand the dangers of faulty cryptosystem design. The instructor will demonstrate a number of open source cryptographic tools to analyze and solve several ciphers and reinforce the principles and techniques learned in the course.

Course 19950

Information Security: Defending the Business

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, and data leakage prevention. 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.

Course 22624

Intrusion Detection

In a hands-on lab, students will use a number of public-domain and commercially available security tools. The instructor will introduce several of the "canned" penetration scripts, readily available for download on the Internet, that may be used against your company and your Web site. Topics include: hacking; detailed analysis of representative attack mechanisms; analysis of specific viruses and worms; forensics investigation; as well as vulnerabilities in UNIX, Linux, Windows IIS, Active Server Pages, CGI, and Java.

Course 2265

IO Concepts and Protocols: PCI Express, Ethernet, and Fibre Channel

This course focuses on IO technologies and walks students through the complexities of IO subsystems in modern computers, and the networking and storage subsystems to which they are attached. After an introduction to the basic concepts of IO, we will delve into the details of PCI Express, Ethernet and Fibre Channel. Discussion will include operation and protocols and an exploration of how these technologies work. We will follow an application's IO request all the way from the system call, to when the data actually makes it out of the wire.

Course 22177

Network Storage Essentials

This course presents an overview of the key technologies and protocols in network storage. Students learn the basic concepts and terminology associated with Direct Attached Storage, Storage Area Networks (SAN), Network Attached Storage (NAS) and Internet Small Computer System Interface (iSCSI). Students will also learn about Fibre Channel (FC) protocol, FC topologies, WWN usage, and FC logins in a SAN or NAS environment. This course will demonstrate how SAN infrastructure facilitates storage consolidation, data sharing, server clustering, LAN-free and server-free backup across heterogeneous host server platforms.

Course 21940

Optical Networks Essentials

This course covers basic concepts in optical communications, including the evolution of DWDM and its emergence as the basis for optical networking; the merger of IP and optical and its impact on future network control structures; the detailed workings of the dominant systems in today's optical networking world, SONET and SDH; IP over optical networking using GMPLS and ASON; challenges in existing optical networking technologies and the future of optical networks. Optical Burst Switching, all-optical networks and various PON (Passive Optical Network) technologies in Access networks are also addressed.

Course 3943

Smart Grid, Introduction

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 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 currently being developed for smart grid and the Smart Grid innovation zones.

Course 22867

Software Security Testing

With software's critical role in today's economy and infrastructure, hackers are constantly attempting to exploit flaws (bugs) in order to steal data and identities, or route spam across the Internet. Today's software needs to be properly tested for security to prevent negative media exposure or other adverse consequences. You will learn application security principles, security testing frameworks, threat modeling, and methods of attacking software applications. This course is intended for software testing professionals or anyone else needing to ensure that applications behave appropriately.

Course 20280

Switching and Routing

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 logic and understanding of how packets are routed through a TCP/IP network and passed between layers 2 and 3. This course is taught using Cisco routers and switches in the lab. Students gain hands-on experience working with the principle hardware in widest use, including operational premises and algorithmic decisions. Students will also learn to configure routing protocols and troubleshoot the network using Cisco IOS commands.

Course 2226

TCP/IP Essentials

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 assignments, name-resolution processing, 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.

Course 0661

USB Device Interface: Architecture, Protocols and Programming

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.

Course 2179

VMware vSphere:

Configuration and Management [V4.1]

Server virtualization has become a critical technology to reduce IT costs and support the rise of cloud computing. The VMware vSphere 4.1 course includes lectures and hands-on labs covering the installation, configuration, and management of VMware ESXi 4.1 and vCenter Server 4.1. 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 are created and used for resource monitoring, VMotion, load balancing, and high availability. This course helps prepare students for the VMware Certified Professional (VCP4) exam and satisfies the VCP4 course requirement.

Course 22869

Wireless Communications, Introduction

This course presents a fundamental approach to the underlying theory of wireless systems and standards, from amplitude modulation (AM), frequency modulation (FM), and Single Side Band (SSB) to present day digital wireless techniques: PSK, TDMA, CDMA, and OFDM. A thorough treatment is given to receiver/transmitter architectures including Tuned RF (TRF), Superhetrodyne, and I-Q techniques. Worldwide standards such as GSM, 802.11, Bluetooth, IS-95, 3G and WiMax will be discussed. The course prepares students for technical work in the wireless field.

Course 5455

Wireless Technologies for Embedded Systems: Bluetooth, WiFi and ZigBee

This course provides practical knowledge of embedded system programming for wireless technologies. Instruction includes UDP and TCP based communications and socket programming, which is the foundation of network programming. The course addresses tradeoff considerations of bandwidth, cost and power among Bluetooth, WiFi and ZigBee. For each technology, the discussion includes architecture, key protocol, programming API and debugging. In the hands-on portion of the course, students design, implement, and demonstrate a wireless-enabled application on a Rabbit development board.

Course 23093

Program Updates and Enrollment Information

Visit ucsc-extension.edu/engineering, for the most up-to-date information about our courses and programs, including textbooks, instructors, schedules and locations.

Enroll online at ucsc-extension.edu.

Send questions to program@ucsc-extension.edu

UCSCextension
Silicon Valley

**Silicon Valley's #1
Professional
Engineering Educator**

Dynamic, Highly Educated Student Body

Nearly 100 percent of the students who enter our programs have Bachelor's degrees—and more than 40 percent already hold graduate degrees. So when studying at UCSC Extension Silicon Valley, you will learn and network with the best and brightest. Working professionals come here to build their careers rather than earn a degree—yet our certificates' quality and recognition have proven instrumental in helping them advance careers.

Wide Variety of Flexible, Competitively Priced Learning Options

We offer highly practical, real-world instruction in dozens of disciplines of high interest and demand in Silicon Valley. Our applied courses provide a theoretical foundation to enhance on-the-job performance. In addition, our programs are very competitively priced—often less than half that of comparable training available elsewhere—with many offered both in classrooms and online. You can take individual courses in any program or earn a full certificate.

Comprehensive Programs for Technology Industries

Our career-oriented education is organized under eleven certificate programs, each representing a significant technology discipline or industry. Course levels vary from basic to advanced. Students can either be beginners in the field, practicing engineers, or job seekers wanting a rigorous program to broaden their skills and enhance their value in the marketplace. Together these programs offer the broadest technology curriculum in Silicon Valley.

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How To Get Started

Go to ucsc-extension.edu. You'll find detailed information about the full range of certificates and courses we offer, including class schedules and online registration. Or call us at (408) 861-3860 for more information. Our program representatives will personally help you plan a schedule that meets your needs.

Program Contact

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