Technology Basics for Non-Technical People

SEVEN INTENSIVE SHORT COURSES

SEPTEMBER - DECEMBER, 2002

ABCs of Semiconductor Fabrication
Boston, Massachusetts, September 9-10
Washington, DC, September 23-24
Fremont, California, October 12 and 19

ABCs of Fiber Optic Technology: Fundamentals and Components
San Francisco, California, October 7-8

Essentials of Computer Technology for Business Professionals
San Francisco, California, October 14-16
Berkeley, California, December 2-4
San Francisco, California, December 9-11

Storage Area Networks & Networking Essentials
San Francisco, California, October 17

ABCs of Electronic Technology
Redwood City, California, October 28-29
San Francisco, California, December 16-17

ABCs of Digital Technology
Redwood City, California, October 31-November 1

ABCs of Fiber Optic Communications: Modules and Networks
San Francisco, California, November 20-21

University of California Berkeley EXTENSION
Continuing Education in Engineering

www.unex.berkeley.edu/eng

The ABCs of Semiconductor Fabrication

Boston, Massachusetts, September 9-10, 2002
Washington, DC, September 23-24, 2002
Fremont, California, October 12 and 19, 2002

Semiconductors have become an increasingly powerful economic force throughout the world today, particularly as the applications of integrated circuits continue to expand, and competition steadily escalates in high-technology development. Semiconductors are the enabling technology of the information revolution. The industry is expected to grow through the next decade and beyond.

To meet the projected worldwide demand for semiconductor devices, semiconductor design companies and manufacturing plants need technical and nontechnical staff and personnel who are well versed in the key elements of fabrication technology. This course presents, in simple terms, a sequential format of information that covers the major fabrication processes for integrated devices (bipolar and MOS technology).

About this course

This is one of three tested, modular short courses on electronics, digital design, and semiconductor processing. Completion of this course and its companion courses, The ABCs of Electronic Technology and The ABCs of Digital Technology, will give you a solid perspective on modern electronics and digital design methodologies and how the designs are implemented in silicon and packaged by the semiconductor industry. All courses are offered frequently and can be taken in any order.

Course goals

This two-day course gives you a comprehensive overview of semiconductor technology. The course gives you the background you need to understand the basics of semiconductor devices, how they work, the processing technologies to produce them, and circuit design techniques.

Course benefits include

- Building a competitive edge in your career by learning the fundamentals of semiconductor technology
- Exploring the basic processes required to fabricate integrated devices
- Learning the essential vocabulary of the semiconductor processing industry
- Understanding the various device types used to build integrated circuits

You learn from simplified models that explain how semiconductor silicon works. Each session involves discussions of various fabrication issues. Topics include a brief review of physics and chemistry basics as they relate to fabrication technology and practical application in that area.

Who should attend

This course is intended for nontechnical individuals associated with the semiconductor industry. Customer/sales associates, marketing and product line representatives, patent attorneys, and other supervisors and managers seeking a background in the fundamentals will gain a concise summary of the essential terms and technology. Engineers, process technicians, and line operators who need a refresher course in the basics, or who are planning to enter the field, will also benefit professionally.

Instructor

MARK S. LANCASTER, M.S.E.E., is an independent consultant. Previously he was a process engineer at Agilent Technologies, working in the area of device fabrication. He has been teaching semiconductor fabrication technology for both UC Berkeley Extension and private companies for more than 10 years. His engaging and well-organized teaching style has consistently won enthusiastic reviews from his students.

Schedule

Check-in: 8:30–9:00 am first day

Lectures: 9:00 am–4:00 pm each day

Lunch: noon–1:00 pm each day

Locations

Boston, Massachusetts: Four Points Sheraton, 1151 Boston-Providence Turnpike, Norwood, Massachusetts 02062
Telephone: (781) 769-7900

Washington, DC: Holiday Inn, 4610 N. Fairfax Drive, Arlington, Virginia 22203
Telephone: (703) 243-9800

Fremont, California: UC Berkeley Extension Fremont Center, 47655-B Warm Springs Blvd.

Fee

The fee is $895. This includes:

- Two full days of instruction (1.2 ceu)
- Comprehensive course notes
- Daily lunches and refreshments

Boston: **EDP 328229**

Washington, DC: **EDP 328237**

Fremont: **EDP 328211**

MCLE credit for attorneys: UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 12 hours.

Topic outline

Introduction to Fabrication

Basic concepts of semiconductor silicon

Silicon doping: n-type and p-type descriptions and terminology

Silicon crystal growth and wafer preparation

Basic overview of major device configurations

Oxidation of Silicon

Overview and formulas associated with thermal oxidation

Oxidation kinetics and growth curves

Oxidation masking: diffusion and implantation

Thin oxide growth

Segregation of impurities during the oxide growth process

Photolithography

Analogies of image transfer

Requirements for a photoresist system

Basic photoresist systems: Negative (-PR) and Positive (+PR)

Outlining the basic photoresist cycle

Photomasking equipment

Masking flow for bipolar/MOS devices

Diffusion

Diffusion theory—Fick's Laws and solutions applicable to the fab process

The thermal diffusion process, equipment, and variables

Dopant impurity distributions and examples

Non-ideal effects and process limitations

Ion Implantation

Conceptual process overview: ion stopping and statistical approximations

Interrelationships between implant variables

The basic ion implanter system

Impurity profiles of implanted ions

Examples of implant applications and profiles

Activation and annealing of implanted ions

Channeling of implanted ions

Epitaxial Deposition

Introduction of the Vapor Phase Epitaxy (VPE) process

Applications of epi layers

Kinetics of the epitaxial growth process

Outdiffusion and autodoping

Chemical Vapor Deposition (CVD) of Amorphous Layers

CVD process description and applications

j2

Silicon nitride

Silicon dioxide

Metal layers

Metallization Methods and Applications

Applications of metal layers in semiconductor device design

Physical Vapor Deposition (PVD) techniques: sputtering

CVD metal: tungsten

Interconnect concepts: silicide/salicide formation

Overview of Etching Techniques

Wet chemical etching

Dry (plasma) etching

Summary and Wrap-Up

Movie ("Silicon Run") illustrating fabrication operations

Industry trends

Fabrication flow for major device types

The ABCs of Fiber Optic Technology: Fundamentals and Components

San Francisco, California, October 7-8, 2002

Fiber optic technology has enabled a revolution in communications that has resulted in unprecedented economic growth and opportunity. However, optical technology in general has remained a "black art" to many people, even since ancient times. This two-day course introduces the fundamentals of optical fiber and fiberoptic devices and is intended to demystify this technology to people having both non-technical and technical backgrounds.

- Come up to speed on photonics—the next-generation of electronics
- Get a competitive edge in your career by understanding photonics
- Learn about light, laser safety, handling and cleaning of optical fiber
- Learn the concepts, building blocks, and terminology of optical networks
- Understand the types, operation, and various impairments of optical fiber
- Understand the functionality of many kinds of photonic devices
- Understand the practical limitations and tradeoffs of optical devices
- Understand the supplier/competitive landscape for optical devices

In this course you gain a broad perspective on this rapidly emerging field, as well as a solid foundation of useful knowledge. This is an introductory course that provides an up-to-date, in depth review of photonics technology with a minimum of mathematics. For example, you learn what a photon is, what basic device fabrication processes are, how optical fiber can transmit data over great distances, how optical fibers have revolutionized surgery, how a laser works, and how various photonic devices function.

The course also covers practical knowledge such as "do's" and "don'ts," fiber-optic connector cleaning, inspection, and maintenance. This course could help you prevent the high cost of inadvertent damage to photonic devices and optical fiber connectors.

About this course

This is the first course of a modular short course series on optical technology. Companion courses include The ABCs of Fiber Optic Communications: Modules and Networks, and The ABCs of Fiber Optic Systems: Sensors and Diagnostics.

Course goals

This two-day course gives you a broad, yet comprehensive overview of fiber optic technology, including fiber, cable, and fiber optic devices. The objective is to understand and demonstrate the basics of photonic technology, how it works, how it is manufactured, who are the key players, how photonic devices are combined to make larger systems, and when they have practical limitations.

Course benefits include

- Learning about light, laser safety, and handling and cleaning of optical fiber
- Understanding the types, operation, and various impairments of optical fiber
- Understanding the functionality of many kinds of photonic devices
- Understanding the supplier/competitive landscape for optical devices

Who should attend

This course is intended for nontechnical or technical individuals with an interest in optical fiber technology. This would include but is not limited to: sales, marketing, and legal professionals, analysts, investors, purchasing staff, technicians, engineers, operators, and managers seeking an entry-level background in photonics. The course is also intended for technical people seeking to enter the field, broaden their knowledge base, or take a refresher course in fiber optic technology.

Prerequisites: No previous experience is required. A background in electronics (technical or nontechnical) and algebra is helpful but not required.

"I am very pleased that the course included many of the relevant technical issues I work with day-to-day. It helps me better communicate in the language my engineering customers speak."

Eric Hundley, Senior Sales Engineer at Tyco Electronics

Instructor

ROBERT DAHLGREN, M.S., is president of Silicon Valley Photonics, a consultancy in advanced optical technology. He has been working in optical technology for more than 20 years. He has previously been employed at Honeywell, Control Data, Sperry Aerospace, Charles Stark Draper Laboratory, Transcendata, and Fujikura Technology. He has worked on diverse areas of optical R&D and engineering, such as microlithography, metrology, passive fiber devices, sensors, avionics, communication transceivers, physics, nuclear testing, and data communications. He is the author of more than ten patents and numerous technical publications, and is a recipient of the IEEE "3rd Millennium" award. He is active in several optical professional societies and is the chairman-emeritus of the award-winning Santa Clara Valley Chapter of the IEEE Lasers & Electro-Optics Society. He received his first M.S. degree from M.I.T in aeronautics/astronautics in 1993, his second M.S. degree from San Jose State University in physics in 2001, and his B.S.E.E. from the University of Minnesota in 1983.

Schedule

Check-in: 8:30-9:00 am first day

Lectures: 9:00 am-4:00 pm each day

Lunch: noon-1:00 pm each day

Location

San Francisco: UC Berkeley Extension Downtown Center, 425 Market Street, 8th Floor (enter on Fremont Street)

Fee

The fee is $995 (**EDP 318493**). This includes:

- Two full days of instruction (1.2 ceu)
- Comprehensive course notes
- One copy of the text *Understanding Fiber Optics*
- Daily lunches and refreshments

MCLE credit for attorneys: UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 12 hours.

Topic outline

Introduction to Photonics

Introduction to light and optics
History of optics and fiber optics
Overview of fiber optics
Overview of communication links
Laser and fiber safety
Fiber handling and hygiene

Optical Fiber & Cable

Introduction to optical fiber
Singlemode fiber
Multimode fiber
Specialty fiber
Fiber manufacturing
Fiber cable
Connectors
Splices

Passive Devices

Adapters
Attenuators
Couplers
WDM devices
Coils and coil winding
Optical switches
Polarization devices
Other passive devices

Active Devices

Semiconductor light sources
Semiconductor light detectors
Optical amplifiers
Optical modulators
Nonreciprocal devices
Other active devices

www.unex.berkeley.edu/eng for information on Engineering short courses

Essentials of Computer Technology for Business Professionals

San Francisco, California, October 14–16, 2002
Berkeley, California, December 2–4, 2002
San Francisco, California, December 9–11, 2002

Information technology plays a critical role in virtually every company's business strategy. Imagine how much more effective you will be with a clear understanding of how computer technology works and fits together. This three-day intensive course gives you that advantage by providing you with a comprehensive overview of the terms and concepts used in computer technology found in corporate enterprises.

We present real-world material and examples in a logical, step-by-step fashion, beginning with the basic elements and building up to corporate IT infrastructure.

Course benefits include

- One of the only in-depth "horizontal courses" available that provides a road map of how computer technology fits together and interacts
- Increases understanding of everything you already know about computer technology, while providing an easy way to rapidly learn new terms
- Demystifies the buzzwords by presenting key computer concepts in a jargon-free, easy-to-follow manner
- Enables you to communicate with information technology professionals
- Assumes no prior exposure to or knowledge of computers
- Applies to all computing environments—not just PCs
- Includes the latest Internet concepts
- Taught by one of Extension's most consistently highly-rated instructors

Who should attend

This course is valuable for all nontechnical or semitechnical individuals seeking to become fluent in the fundamental concepts and terms used in today's corporate computing environment. Executives, managers, legal professionals, investment analysts, customer service and sales associates, financial, marketing, and operations staff, and support personnel from all departments will all benefit professionally.

Instructor

ERIC BRAUN, M.A., B.S.E.E., has more than 22 years of experience in the computer industry. He holds a master's in Psychology in Education from Stanford University and a bachelor's of Electronic Engineering with a minor in Computer Science from New York Institute of Technology. His multidisciplinary background gives him a unique ability to deliver complex technical concepts to non-technical and technical professionals. Eric has trained some of the top business strategists internationally. He teaches from broad technical experience that includes system integration and design, application software design, and field application engineering. He is also an instructor at the Stanford University Continuing Education Program, UC Irvine Extension, and has taught technology courses on UNIX programming and Internet/intranet design and implementation for Learning Tree International. Mr. Braun is the founder of and managing principal at Applied Wisdom Corp., a technology consulting and educational company. He serves as an expert witness on Internet and other technology-related issues, and as an advisor to firms on technology matters. His clients include Bain & Co., the U.S. Department of Labor, Dun & Bradstreet, McKesson, Unisys, Thomson Healthcare-Medical Economics, Adaptec, EMC Corporation, Network Appliance, University Technology Ventures and various law firms. Send questions to eric_braun@stanfordalumni.org.

Schedule

Check-in: 8:30 am–9:00 am first day

Lectures: 9:00 am–4:00 pm each day

Lunch: noon–1:00 pm each day

Locations

San Francisco: UC Extension Downtown Center, 425 Market Street, 8th Floor (enter on Fremont Street)

Berkeley: UC Berkeley Extension, 1995 University Avenue

"A very useful class and valuable class that most professionals should take."

Fee

The fee is $1,095. This includes:

- Three full days of instruction (1.8 ceu)
- Comprehensive course notes
- Daily lunches and refreshments

San Francisco: **EDP 308312**
Berkeley: **EDP 308338**
San Francisco: **EDP 308247**

MCLE credit for attorneys UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 18 hours.

Topic outline

Orientation

Up-Front Essentials

How to rapidly assess any system

Binary systems

Analog vs. digital

Measuring time and data

Hardware vs. software

Hardware: The Small Stuff—Microchips and Circuits

Semiconductors: Managing electrons

Logic gates

Integrated circuits

Hardware: Computer System Internals

Power supplies

CPU functionality and architecture; coprocessors

Memory: RAM, ROM, cache memory, flash memory, virtual memory, firmware

Storage: hard disks, SCSI, RAID technology, storage methodologies, optical disks, tape devices, CD-ROM, DVD

Input/output ports: serial, parallel, network, A/D & D/A conversion, USB, Firewire

Buses

Hardware: Computer Systems

A survey of systems and what differentiates one from another

Single-user systems

Multiuser systems: servers, entry-level, mid-range, high-end systems, multiprocessor systems, fault-tolerant systems, clusters, mainframes, supercomputers

Hardware: Networks, Data Communication, Intranets, and the Internet

Network applications

Network types: local (LAN), metropolitan (MAN), wide-area networks (WAN), storage-area networks (SAN)

The underlying structures of the Internet, intranets, and extranets; TCP/IP

Protocol stacks—the "OSI" seven-layer network model

Connection speeds: ATM, DSL, T1, T3, OC48

Topologies: bus, ring, star, hybrid

Network architecture: client/server, peer-to-peer

Devices: Ethernet, Token Ring, Fibre Channel, bridges, routers, gateways

Modems: types and standards

Data security: firewalls, proxy servers; data encryption; public key encryption; virtual private networks

Software: Operating Systems

OS concepts and their implications in application development

The kernel/shell model

OS examples and their implications in the marketplace: MS-DOS, Windows CE, Windows 98, OS/2, Mac OS, Windows NT/2000, UNIX, Linux

Software: Programming Concepts

Computer languages

Interpreters & Compilers

Object-Oriented programming

Middleware

Web Services

Storage Area Networks & Networking Essentials

San Francisco, California, October 17, 2002

The current paradigm shift is towards distributed storage. Storage networking requirements—in capacity, wide-area connectivity, and bandwidth—are expected to rise significantly over the coming years.

This one-day intensive seminar provides you with the working knowledge necessary to understand and apply the key principles and concepts of Storage Area Networks (SANs)—both Fibre Channel and IP-based—for solving real-world storage issues.

Course benefits include

- Defines key SAN, NAS, and network concepts and terminology
- Presents real-world material and examples in a logical sequence
- Includes networking concepts since SANs will increasingly be implemented using conventional IP technology as well as interconnected over IP-based WANs
- Teaches how to apply SANs for enterprise storage solutions such as heterogeneous data integration, high performance and availability clusters, LAN and server-free backups, better storage resource utilization and management, disaster recovery, etc.
- Details on emerging IP storage technology
- Provides a list of useful resource links

Who should attend

This course is intended for technical and semi-technical people who need to understand the concepts, terms, and applications of storage area networks—technical marketing and sales, IT personnel (CFO, CIO, directors, implementers, administrators, system architects, consultants, integrators), industry and financial analysts, technical public relations, lawyers, purchasing professionals, etc.

Prerequisites

- Basic understanding of client/server architectures and applications
- Familiarity with conventional storage technologies such as RAID and SCSI
- A solid basis of enterprise infrastructure including the above two bullets can be obtained by first attending Essentials of Computer Technology for Business Professionals

Instructor

ERIC BRAUN, M.A., B.S.E.E. (see page 6 for biographical information)

Schedule

Check-in: 8:30 am-9:00 am

Lectures: 9:00 am-5:00 pm

Lunch: noon-1:00 pm

Location

San Francisco: UC Extension Downtown Center, 425 Market Street, 8th Floor (enter on Fremont Street)

Fee

The fee is $595 (**EDP 308320**). This includes:

- One full day of instruction (0.7 ceu)
- Comprehensive course notes
- Lunch and refreshments

MCLE credit for attorneys: UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 7 hours.

Topic outline

Networking Essentials

OSI 7-layer network model

Packet-switching

TCP/IP and the Internet, IPv4 and IPv6

Network topology

Types of networks: LAN/MAN/WAN

LAN technologies: Ethernet (10,100,1000base, shared, switched), Token Ring

WAN & MAN technologies: Gigabit Ethernet, 10 GbE, fixed wireless, frame relay, ATM, SONET OC-carrier, DWDM, Packet-over-SONET (PoS)

Access technologies: Cable Broadband, DSL, T-carrier

Network devices: Network Interface Cards (NICs), hubs, switches, bridges, routers, gateways

Network management software: key functions

SAN Essentials and Key Technologies

The challenge—how to address the growing needs for storage

Limitations of direct-attach storage

Network-attached storage (NAS) in a non-SAN environment

Storage Area Networks definition

Benefits of SAN over direct-attach storage

Fibre Channel—definition, protocol stack

SAN topology—point-to-point, arbitrated loops, switched, fabrics

SAN building blocks—JBOD & RAID arrays, NAS in a SAN, backup components, Fibre Channel HBA cards, GBICs & extenders, loop hubs, switched hubs, fabric switches, bridges (SCSI-to-FC), Directors

SAN vs. NAS comparison

SAN applications—real world examples

SAN management software—major functions, storage virtualization (zoning, LUNs, mapping)

Backup management—major functions, serverless, LAN-less backups

IP Storage

Limitations of Fibre Channel SAN solutions

Fibre Channel over IP (FCIP)

iFCP

iSCSI definition, characteristics, benefits

How iSCSI solves FC SAN limitations

Comparison of SCSI, Fibre Channel, iSCSI

Which Fibre Channel components can be replaced by iSCSI

IP storage SAN example

Technology timeline for emerging SAN products and standards

Bibliography, Resources & Links

The ABCs of Electronic Technology

Redwood City, California, October 28-29, 2002
San Francisco, California, December 16-17, 2002

Electronic technology has rapidly worked its way into a diverse array of applications. For non-electrical engineers and other nontechnical staff, the challenge of developing a working knowledge of the electronic devices, circuits, and systems encountered in their daily work is a formidable one. However, those who make the effort to develop an understanding of basic electronics to combine with expertise in their specific discipline become invaluable assets to their organization.

About this course

This is one of three tested, modular short courses on electronics, digital design, and semiconductor processing. Completion of this course and its companion courses, The ABCs of Digital Technology and The ABCs of Semiconductor Fabrication, will give you a solid perspective on modern electronics and digital design methodologies, and on how designs are implemented in silicon and packaged by the semiconductor industry. All courses are offered frequently and can be taken in any order.

Course description

This two-day practical course provides non-electrical engineers with a clear, jargon-free study of high-tech electronics fundamentals. The material is presented in a logical, step-by-step progression that starts with basic concepts and concludes with state-of-the-art microcomputer fundamentals.

The course structure blends a lecture/discussion format with reinforcement exercises. The function of various circuits and their components is discussed as well as described by basic mathematical equations. Prior electronics education is not required, and for those having limited exposure to electronics, this course provides new insights and timely information on components, circuit and systems applications, and related technologies.

Who should attend

The course is intended for individuals from a non-electrical engineering background with limited or no prior knowledge or experience in electronics. Basic algebra and geometry is used to illustrate the functions of various circuits and their components. People who will benefit from the course include managers and designers; purchasing, legal, quality, and sales personnel; and engineering/manufacturing technicians—along with others who desire a better grasp of electrical engineering fundamentals in order to be more effective in their daily duties.

Instructor

ROBERT HANSON, M.S.E.E. (see page 11 for biographical information)

Schedule

Check-in: 8:00–8:30 am first day

Lectures: 8:30 am–5:00 pm each day

Lunch: noon–1:00 pm each day

Locations

Redwood City: UC Berkeley Extension Peninsula Center, 1991 Broadway

San Francisco: UC Berkeley Extension Downtown Center, 425 Market Street, 8th Floor (enter on Fremont Street)

Fee

The fee is $895. This includes:

- Two full days of instruction (1.4 ceu)
- One copy of *Electricity and Electronics* by Howard Gerrish and William E. Duggen
- Comprehensive course notes
- Daily lunches and refreshments

Redwood City: **EDP 308288**
San Francisco: **EDP 308296**

MCLE credit for attorneys UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 14 hours.

What you learn

- The fundamentals of electricity and electronics
- Alternating current principles and parameters: resistance, capacitance, and inductance
- Semiconductor electronic devices from diodes, FETs, and transistors to integrated circuits and amplifiers, including CMOS, PMOS, and NMOS devices, PLDs, FPGAs
- Digital circuits, binary logic, logic gates, flip-flops, computers and how they function, computer components, CPU, ALU, PROM, RAM

Topic outline

DAY 1

Fundamentals of Electricity and Electronics

The science of electricity and electronics—matter, atoms, molecules, electrons, protons, neutrons, voltage, and current

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The ABCs of Electronic Technology

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Circuits: Providing the Pathway for Using Electricity

How a circuit uses electricity

The four key elements of a circuit: source, load, pathway, and switch

Measuring the four elements of electrical circuits using volt meters, ammeters, ohmmeters, watt meters (using Watt's law)

Resistance and Inductance in Circuits

Figuring out the amps/current, ohms/resistance, and voltage in a circuit: Ohm's law and Kirchhoff's laws

Using resistors to limit the current to a specified amount through the circuit

Using inductors to oppose changes in currents to provide control over the rate of circuit activation

Two kinds of inductance: serial and parallel

What happens in a circuit when current is changing? Transient response

Changing the voltage and the current in a circuit: transformers

How power is consumed by resistors (real power: watts) and how power is absorbed, stored, and released by inductors (reactive power: volt amps)

The importance of the power factor

How to figure out the power factor from the inductance and resistance

The biggest hurdle in making circuits go faster: the inductance

The importance and properties of time constant and inductance in high-speed circuits

DAY 2

Capacitance in Circuits

What is a capacitor? How is it different from an inductor?

Types of capacitors: aluminum electrolytic, ceramic, tantalum, mica, polystyrene, polarized, variable, and others

The time required to charge a capacitor: RC time constant

Equivalent capacitance in series and parallel circuits

What happens in a capacitor when currents change? Transient response

Reactive power in capacitors

Capacitance issues in today's printed circuit boards and why capacitance must be controlled in high-speed operation of microprocessors, RAMs, FPGAs, etc.

Basic Electronic Devices

The difference between analog and digital circuits

Why do computers use almost exclusively digital circuits?

What are silicon devices? How are they laid out?

Basic silicon devices: diodes, transistors, and FETs

How silicon devices are constructed: doping, P-N junction, layout

Integrated Circuits

What is an integrated circuit?

How are integrated circuits constructed?

Common types of infrastructures for integrated circuits: MOS devices, CMOS, NMOS, PMOS. Examples of these devices for constructing PLDs and PLAs.

Which types of integrated circuits are most popular in today's electronic products and why?

How do integrated circuits work?

What are the methods for constructing amplifiers and linear integrated circuits?

Using NPN and PNP transistors; how to bias amplifiers and linear integrated circuits to make them function; deciding how you want the amplifier to operate; and working to get a specified voltage and current gain

Digital Circuits

What are digital circuits?

Using binary numbering systems employed by all digital circuits

Basic elements of digital information: bits and bytes

The basic elements of digital circuits: logic gates

Types of logic gates: OR, NOR, AND, NAND, XOR.

Flip flops: combinations of logic gates which provide the basic building blocks for RAMs and PROMs

The two types of flip-flops: D and JK

Computers

History of computers

Microprocessors and mini-computers: what are the fastest ones?

How a computer works

How does the memory work (RAMs and PROMs)? Which are the fastest?

How is programming for ROMs, PROMs, EPROMs, EEPROMs, and flash RAM done?

What are RDRAMs and double density clocking? How fast they can operate? What type of RAMs and PROMs will be used in the future?

Storage technologies used in computers

LEDs and LCD flat pane displays

Why is Moore's Law (that every 18 months the speed of computers will double) no longer a law?

Communication Gear

What are ADSL, DWDM, SONET, and SERDES?

How fast, what are the risks, what is the cost, and what are the future expectations for these communication technologies?

What are LANs, WANs, and MANs?

Why are fiber optics becoming more popular for high-speed communications?

The ABCs of Digital Technology

Redwood City, California, October 31-November 1, 2002

The first major applications for digital circuits were essentially confined to computer equipment. However, digital circuits and digital signal-processing techniques enhance the performance of equipment in such diverse business applications as communications, medical electronics, automotive electronics, and industrial process control. The most prevalent of all digital systems is the personal computer, which exemplifies a system that encompasses all types of digital circuits. This seminar focuses on the digital ICs that are the building blocks in a PC. Starting with basic logic-gate operations, the seminar carries you step-by-step through displays, memories, counters, I/O devices, and arithmetic circuits, finally offering you an opportunity to combine all components to build a PC.

About this course

This is one of three tested, modular short courses on electronics, digital design, and semiconductor processing. Completion of this course and its companion courses, The ABCs of Electronic Technology and The ABCs of Semiconductor Fabrication, will give you a solid perspective on modern electronics and digital design methodologies, and on how designs are implemented in silicon and packaged by the semiconductor industry. All courses are offered frequently and can be taken in any order.

Course goals

This two-day course gives you a comprehensive overview of digital design fundamentals. You learn design essentials while gaining a working knowledge of how real-world digital systems are implemented on the manufacturing floor. This is not just another survey course.

Course benefits include

- Building a competitive edge in your career by gaining a working knowledge of how digital systems are implemented
- Learning how to interpret integrated circuit specifications
- Understanding basic circuit assembly and manufacturing processes
- Acquiring a familiarity with the applications of digital building block ICs in practical electronic systems

Who should attend

This course is intended for engineering personnel who are not electronics specialists. Customer/sales associates, marketing and product line representatives, patent attorneys, and other supervisors and managers seeking a background in the fundamentals will gain a concise summary of the essential terms and concepts. Mechanical engineers, packaging engineers, chemical engineers, designer/drafters, technicians, and those who need a refresher course in the basics, or who are planning to enter the field, will also benefit professionally.

Instructor

ROBERT HANSON, M.S.E.E., heads AmeriCom Test and SMT Technology Inc., a test and manufacturing consulting company. He has more than 30 years of experience in the manufacturing and test areas. He has extensive experience designing test hardware and operational/test software. He has been Testability Overseer for Boeing Commercial Airline products. Mr. Hanson has an M.S.E.E. from the University of Southern California, a B.S.E.E. from the University of Washington, and a B.S.I.E. and a B.S.B.A. from the University of North Dakota. He is a member of the American Society of Test Engineers, Surface Mount Technology Association, and Society of Manufacturing Engineers. He has conducted tutorials and workshops at numerous trade shows, symposiums, and conferences in the United States and internationally.

Schedule

Check-in: 8:00–8:30 am first day

Lectures: 8:30 am–5:00 pm each day

Lunch: noon–1:00 pm each day

Location

Redwood City: UC Berkeley Extension Peninsula Center, 1991 Broadway

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The ABCs of Digital Technology

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Fee

The fee is $895 (**EDP 308304**). This includes:

- Two full days of instruction (1.4 ceu)
- Comprehensive course notes
- *Digital Electronics* (Roger J. Tokheim, 4th ed., Glencoe/McGraw-Hill, 1994)
- Daily lunches and refreshments

MCLE credit for attorneys: UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 14 hours.

Topic outline

DAY 1

Digital Electronics

What is a digital circuit?

Where are digital circuits used?

Why use digital circuits?

Numbers Used in Digital Electronics

Counting in decimal and binary; place value

Binary to decimal conversion

Decimal to binary conversion

Digital IC Basics

Device construction and processes

Diodes and transistors, FETs

Common integrated circuit types

MOS devices—CMOS, NMOS, PMOS, PLDs, and FPGAs

Binary Logic Gates

AND, OR, inverter, buffer, NAND, NOR, and exclusive OR

Multi-input gates

Practical TTL and CMOS logic gates

Using Binary Logic Gates

Boolean expressions

Constructing circuits

Sample problems for simplifying Boolean expressions

IC Specifications and Simple Interfacing

Logic levels and noise margins

Specifications for MOS and CMOS digital ICs

Interfacing TTL and CMOS with switches, LED and logic interfacing

DAY 2

Encoding, Decoding, and 7 Segment Displays

Codes (8241, BCD, Gray, and ASCII) encoders

7 segment decoder/drivers

Liquid crystal displays

Using CMOS to drive an LCD display

Flip-Flops

R-S and clocked R-S

Flip-flop operation

D and J-K flip-flops, IC latches

Triggering flip-flops and Schmitt triggers

Counters

Various types of counters

Counters as frequency dividers

TTL and CMOS IC counters

Shift Registers

Serial load

Parallel load

Universal 8-bit CMOS shift register

Using shift registers

Arithmetic Circuits

Half and full adders

Arithmetic logic units

Subtractors

Memories

Random access memory (RAM), static and dynamic RAM ICs, read only memory (ROM)

Using a ROM and programmable read only memory (PROM), other memory devices

Operation and programming of ROM, PROM, EPROM, EEPROM, and flash RAM

ABCs of Fiber Optic Communications: Modules and Networks

San Francisco, California, November 20-21, 2002

Fiber optic technology has enabled a revolution in communications that has resulted in unprecedented economic growth and opportunity. This two-day course builds upon the concepts presented in The ABCs of Fiber Optic Technology: Fundamentals and Components. This course is intended to explain the fundamentals of fiber optic communications and its enabling technologies to people having both non-technical and technical backgrounds.

- Come up to speed on optical communication – the backbone of the internet
- Learn about telecom, datacom, and the convergence of these two networks
- Learn about broadcast optical networks such as cable television and PON
- Learn about other types of networks such as free-space optical communications
- Understand the various protocols in use over fiber optic networks such as FDDI, SONET, Fibre Channel, ATM, Gigabit Ethernet, and 10-Gigabit Ethernet
- Understand the practical limitations and tradeoffs of fiber types, protocols, costs, and topologies for various types of optical networks
- Understand the functionality of box-level equipment
- Understand the functionality of module-level devices
- Understand the supplier/competitive landscape for modules and equipment

In this course you gain a broad perspective on this rapidly emerging field, as well as a solid foundation of useful knowledge. This is an introductory course that provides an up-to-date, in depth review of optical communications technology with a minimum of mathematics. For example, starting at the component-level, the building blocks of the network are examined for each of the "physical layers" of the network. You will learn what a network is, and how it's architecture is determined, and eventually built, given constraints imposed the end-user.

About this course

This is the second course of a modular short course series on optical technology. Companion courses include The ABCs of Fiber Optic Technology: Fundamentals and Components, and The ABCs of Fiber Optic Systems: Sensors and Diagnostics.

Course goals

This two-day course gives you a broad, yet comprehensive overview of fiber optic communications systems, including datacom, telecom, cable television, and other optical networks. The objective is to understand and demonstrate the basics of optical communications, module-level subsystems, how optical networks are assembled, and how they function.

Course benefits include

- Gain an understanding of the fundamental concepts and terminology of fiber optic networks
- Gain and introductory understanding of the various module-level devices
- Understand the interconnection of equipment for various applications
- Know the major standards, protocols, and players in the market landscape

Who should attend

This course is intended for non-technical or technical individuals with an interest in optical communications. This would include but not be limited to: sales, marketing, and legal professionals, analysts, investors, purchasing staff, technicians, engineers, operators, and managers seeking an entry-level background in photonics. This course is also intended for technical people seeking to enter the field, broaden their knowledge base, or take a refresher course in fiber optic technology.

Instructor

ROBERT DAHLGREN, M.S. (see page 5 for biographical information)

Schedule

Check-in: 8:30-9:00 am first day

Lectures: 9:00 am-4:00 pm each day

Lunch: noon-1:00 pm each day

Location

San Francisco: UC Berkeley Extension Downtown Center, 425 Market Street, 8th Floor (enter on Fremont Street)

Fee

The fee is $995 (**EDP 338186**). This includes:

- Two full days of instruction (1.2 ceu)
- Comprehensive course notes
- One copy of the text *Understanding Fiber Optics*
- Daily lunches and refreshments

MCLE credit for attorneys

UC Berkeley Extension certifies that this activity has been approved for MCLE credit by the State Bar of California in the amount of 12 hours.

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Topic outline

Introduction to Optical Communications
Introduction to communications
History of optical communications
Review of optical fiber
Review of passive devices
Review of active devices
Fundamentals of communications
Fundamentals of networks

Module-Level Devices
Overview
PHY standards
Optical subassemblies
Transmitter
Receiver
Transceiver/transponder
Erbium-doped fiber amplifier
Semiconductor optical amplifier

Box-Level Equipment
Overview
Transparent vs. opaque switches
Digital/multi-service cross-connects
Optical cross-connect switch
Optical add-drop multiplexer
Optical network router
Regenerate/retime/reshape
Dispersion compensation
Dynamic gain equalizer
Protection/provisioning

Optical Networking
Overview
Link design
Protocols
Point-to-point
Linear, ring, mesh topologies
WDM networks
Long-haul networks
Metro/regional networks
Access networks
Local area networks
Passive optical and CATV
Free-space optical networks

Enrollment Information

Enrollment information

Enrollment may be made by companies or individuals. **Enrollment is limited and advance enrollment is required.** Upon request, a place in the course will be reserved for individuals who require time to obtain authorization.To reserve a place, call (510) 642-4151 or fax (510) 642-6027.

How to enroll

By mail: Fill out and return the enrollment form provided.

By phone: You may enroll by phone if you use Visa, MasterCard, or American Express; call (510) 642-4111.

By fax: If you use MasterCard, Visa, or American Express, fill out the form on the back cover of this brochure and send it via fax number (510) 642-6027. Please be sure to fax the entire form, including the mailing label if there is one. Please provide all the information requested on the form.

Online: You can enroll via the Internet at www.unex.berkeley.edu/enroll

By purchase order: Companies, agencies, and other organizations may pay course fees by purchase order.

Enrollments must be accompanied by the full fee or by purchase order authorization. You may pay by check or use Visa, MasterCard, or American Express. Make checks payable to the UC Regents.

For efficient enrollment processing, we must have the Priority Code from this publication, whether or not it is addressed to you. This five-digit code (three numbers and two letters) appears on the mailing label above the addressee's name. If there is no label on your copy, the code appears in a box in the middle of the address surface.

Confirming your enrollment: If you enroll and have not received an enrollment confirmation five days prior to the scheduled date of the course, please call (510) 642-4151 to confirm that the course will convene as scheduled. Since Extension is self-supporting, it is necessary to establish a minimum enrollment. If the minimum is not met at least a week prior to the course date, the course may be canceled; if so, enrollees will be notified.

Refund policy: Any cancellation is subject to a $30 processing fee. Cancellations received less than five working days from the start of the course are subject to a $100 cancellation fee. **Substitutions may be made at any time.** If the course is not held for any reason, UC Berkeley Extension's liability is limited to refund of the full course fee.

Further information

Housing and transportation: Maps and information will be mailed to enrollees.

Continuing education units (ceu): These units are a nationally recognized means of recording noncredit study and are accepted by many employers and relicensure agencies as evidence of a serious commitment to career advancement and the maintenance of professional competence. One ceu is awarded for each 10 hours of attendance. If you want us to keep a record of your ceu study, you must sign a form that will be distributed in class.

If you have questions, call (510) 642-4151, fax (510) 642-6027, e-mail course@unx.berkeley.edu, or write to Continuing Education in Engineering, University Extension, University of California, 1995 University Ave., Berkeley, CA 94720-7010.

Internet: Information about Extension including the complete Extension catalog is available on the Internet at www.unex.berkeley.edu

For a free catalog: Call toll-free
1 888 UC SMART

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Program representatives

Jenny Black Deer and Anita Wells,
Continuing Education in Engineering, University Extension, University of California, Berkeley

Be sure to provide us with the **five-digit priority code**. On the mailing label, the code appears in the upper right area (whether or not it is addressed to you).

Please PRINT the following information. For additional registration, please duplicate this form.

EXAMPLE

**********CAR-RT LOT ** C-038
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PHOEBE BROWN
1110 MAIN ST
BERKELEY, CA 94700-6407

❑ **Mr.** ❑ **Ms.** **The address below or on the label is my** ❑ **Home** ❑ **Business.**

Name (last / first / initial)

Company/ Agency (for business address only)

Address (number / street / apt./suite/mail stop)

(city / state / zip)

Daytime phone – – – ext. **Evening phone** – –

Fax phone – – **E-mail**

Title/ Occupation

Social Security number – –

The University is required by federal law to report your Social Security number and other pertinent information to the Internal Revenue Service pursuant to the reporting requirements imposed by the Taxpayer Relief Act of 1997. The University also will use the Social Security number you provide to verify your identity. Social Security number disclosure is mandatory. This notification is provided to you as required by the Federal Privacy Act of 1974.

Courses: The course EDP number is essential for processing your enrollment. You'll find it at the end of the course description following the fee. You may copy this form as needed. ***Note:*** **Students with special needs, please call (510) 643-5732.**

Course Title	**Fee**
Location (city) **Beginning Date** **EDP Number**	$
Course Title	**Fee**
Location (city) **Beginning Date** **EDP Number**	$

❑ **Visa** ❑ **MasterCard** ❑ **American Express**

– – – / date card expires

Total Payment $

Refund policy is under Enrollment Information.

authorizing signature

❑ **To pay by check. Make check payable to the UC Regents.**

❑ **To pay by purchase order. This form must accompany your purchase order. Fax to (510) 642-3910.**

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Enroll by fax with MasterCard, Visa, or American Express at **(510) 642-0374**; or with a company purchase order at **(510) 642-3910**.

Enroll online, visit www.unex.berkeley.edu/enroll

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