Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 001A: Engineering Circuit Analysis I

Course Description
Ohm's law and Kirchoff's laws; nodal and loop analysis; analysis of linear circuits; network theorems; transients in RLC circuits. Application of SPICE to circuit analysis.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
MATH 046, PHYS 040C (both may be taken concurrently); concurrent enrollment in EE 01LA.

Textbooks and Related Materials
A. Electric Circuits w/PSpice, 7th edition (TK454 .N54 2005), J. Nilsson & S. Riedel, 7th ed., Prentice-Hall, 2005.
B. EE 1LA Lab Manual

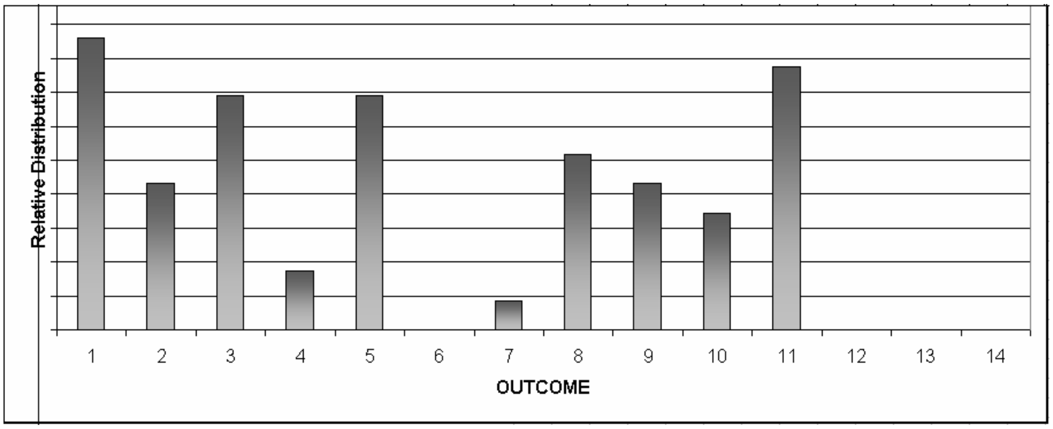
Course Objectives
Be able to apply Ohm's law, Kirchhoff's laws, and developed node-voltage/mesh-current techniques to solve resistive circuits; understand the properties of basic circuit elements; solve the first-order and second-order circuits.

Topics
- Basic concepts, circuit variables and units
- Fundamental circuit elements
- Kirchoff's current and voltage laws
- Resistive circuits
- Node-voltage and mesh-current analysis techniques
- Operational amplifier
- Inductors and capacitors
- Responses of RC, RL, RLC circuits
- Circuit analysis with software PSpice

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course teaches students how to apply knowledge in physics and differential equations to solve circuits.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Zhengyuan (Daniel) Xu
	Graduate Assistant:	Jack Kao
Date:	April 27th, 2006	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 01LA: Engineering Circuit Analysis I Laboratory

Course Description
Laboratory experiments closely tied to the lecture material of EE 1A: resistive circuits, attenuation and amplification, network theorems and superposition, operational amplifiers, transient response. Application of SPICE to circuit analysis.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
EE001A (maybe be taken concurrently).

Textbooks and Related Materials
C. Electric Circuits w/PSpice, 7th edition (TK454 .N54 2005), J. Nilsson & S. Riedel, 7th ed., Prentice-Hall, 2005.
D. EE 1LA Lab Manual

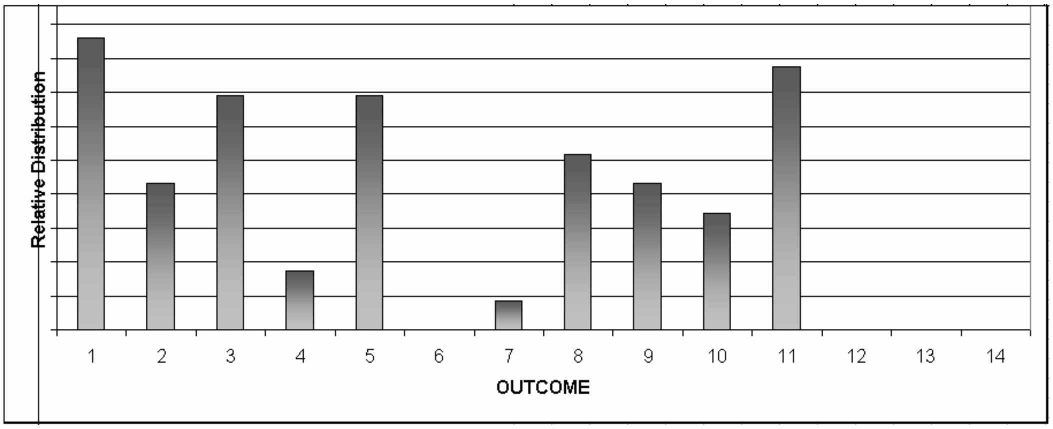
Course Objectives
To understand circuit theories from the lecture course and apply them to solve circuit problems experimentally.

Topics
- Basic concepts, circuit variables and units
- Fundamental circuit elements
- Kirchoff's current and voltage laws
- Resistive circuits
- Node-voltage and mesh-current analysis techniques
- Operational amplifier
- Inductors and capacitors
- Responses of RC, RL, RLC circuits
- Circuit analysis with software PSpice

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
Through this lab course, students will gain sufficient experimental skills on constructing circuits and testing circuit responses.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Zhengyuan (Daniel) Xu
	Graduate Assistant:	Jack Kao
Date:	April 27th, 2006	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 1B: Engineering Circuit Analysis II

Course Description
Sinusoidal steady state analysis, polyphase circuits, magnetically coupled networks, frequency characteristics, Laplace and Fourier transforms, Laplace and Fourier analysis. Application of SPICE to complicated circuit analysis.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
EE1A and EE1LA.

Textbooks and Related Materials
E. J.W. Nilsson and S. A. Riedel, *Electric Circuits*, 7th edition, Prentice-Hall, 2004. (Reserved)
F. EE1B Lab Manual

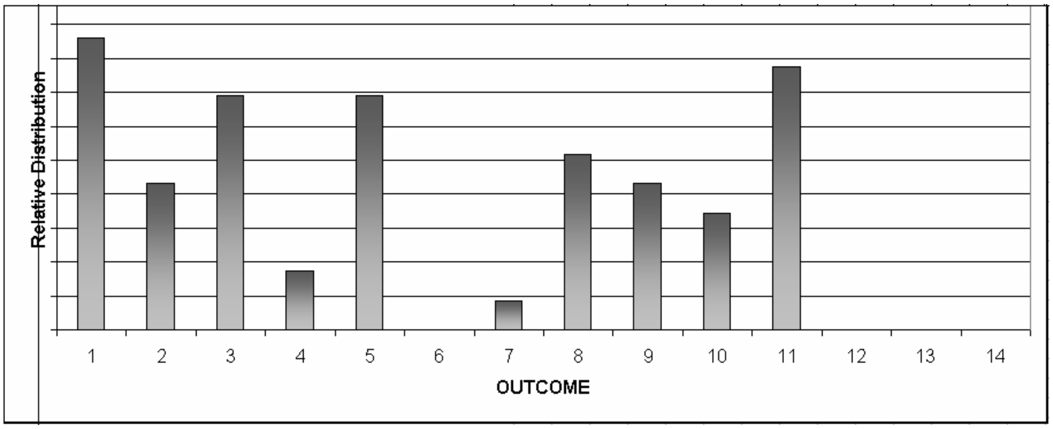
Course Objectives
1. Understand and be able to explain the concept of phasor.
2. Apply phasor analysis to determine the sinusoidal steady state response of various RLC circuit configurations.
3. Apply KVL, KCL, and Thevenin techniques in the phasor domain.
4. Be able to calculate complex power, average power and reactive power based on phasor.
5. Be able to calculate Laplace transform and inverse Laplace transform. Understand the initial- and final-value Theorems.
6. Apply Laplace transform in circuit analysis. Know how to transfer a circuit to s-domain, how to analyze it in s-domain.
7. Understand the definition and significance of the transfer function, and be able to derive the transfer function for a circuit.
8. Understand the relationship between the transfer function and the impulse response. Be able to derive the steady-state response by using transfer function.
9. Know the RL, RC, RLC circuit configurations that act as filters.

Topics
- Sinusoidal Steady-State Analysis
- Sinusoidal Steady-State Power Calculations
- Introduction to the Laplace Transform
- The Laplace Transform in Circuit Analysis
- Introduction to Frequency Selective Circuits

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course provides the students some basic analysis methods and techniques, such as Phasor method, Laplace transform etc., to analyze AC circuits in both time domain and frequency domain. Students can also get some hand-on experience in circuits' connection and PSPICE analysis.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Peilin Fu
	Graduate Assistant:	Jack Kao

Date: May 2nd, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 100A: Electronic Circuits

Course Description
Electronic systems, linear circuits, operational amplifiers, diodes, nonlinear circuit applications, junction and metal-oxide-semiconductor field-effect transistors, bipolar junction transistors, MOS and bipolar digital circuits. Laboratory experiments are performed in the subject areas and SPICE simulation is used.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
EE1B.

Textbooks and Related Materials
- Text: *Microelectronic Circuits,* 5th edition, A.S. Sedra and K.C. Smith, Oxford Univ. Press, 2004.
- Reference: *Introduction to PSpice for Electric Circuits*, 6th ed., James W. Nilsson and Susan A. Riedel, Prentice Hall, NJ, 2001. ISBN: 0-13-009470-6.
- Online reference: http://www.orcad.com/pspicead.aspx

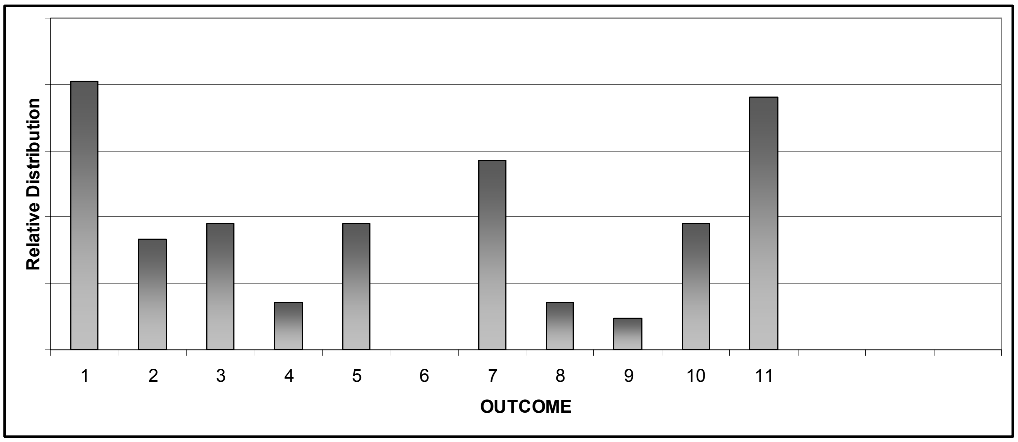
Course Objectives
The objective of this course and the accompanying EE100B is to develop students' ability to analyze and design electronic circuits. The emphasis is on analog circuits.
LEARNING OBJECTIVES
1. Explain the basic operation and characteristics of semiconductor diodes, bipolar junction transistors (BJTs), and metal-oxide-semiconductor field-effect transistors (MOSFETs).
2. Design and analyze a rectifier circuit consisting of diodes, transformer, filter, and voltage regulator.
3. Design and analyze an amplifying stage based on the BJT or MOSFET.
4. Use small-signal models of the BJT and MOSFET for circuit analysis.
5. Analyze operation of a switching circuit based on BJT or MOSFET.
6. Perform laboratory experiments with simple electronic circuits containing semiconductor diodes, BJTs, and MOSFETs.
7. Write reports on performed laboratory experiments.
8. Use simulation software SPICE for analysis of electronic circuits.

Topics
- Introduction (chapter 1)
- Diodes and analysis of diode circuits (chapter 3)
- BJT and BJT circuit analysis (chapter 5)
- MOSFET and MOSFET circuit analysis (chapter 4)

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course provides an important skill of analysis of electronic circuits. It requires a significant use of college-level mathematics and also provides an experimental experience with electronic circuits.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Alexander Korotkov
	Graduate Assistant:	Jack Kao

Date: April 27th, 2006

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 100B: Electronic Circuits

Course Description
Differential and multistage amplifiers, output stages and power amplifiers, frequency response, feedback, analog integrated circuits, filters, tuned amplifiers, and oscillators. Laboratory experiments are performed in the subject areas and SPICE simulation is used.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
EE 100A.

Textbooks and Related Materials
A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, 5th Edition, Oxford University Press, 2004.

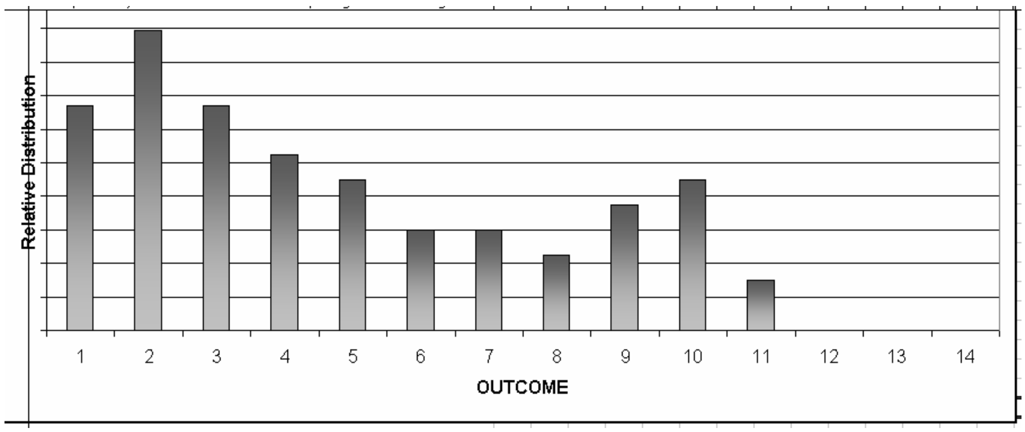
Course Objectives
1. Explain what the input, intermediate, and output stages of an operational amplifier are.
2. Calculate differential gain, input and output resistances of an active-loaded differential amplifier.
3. Become familiar with the principles of negative and positive feedback.
4. Understand four feedback topologies and be able to find gain with feedback as well as input and output resistances with feedback.
5. Know the operation of sinusoidal oscillators as well as generators of square and triangular wave-shapes; calculate frequency and amplitude of an oscillator.
6. Understand the operation of basic circuits used to convert analog signal to digital form and vice versa.
7. Explain the circuitry of NOT, AND, and OR logic gates.
8. Become familiar with the current and future trends of CMOS technology.

Topics
- Differential and multistage amplifiers
- Feedback
- Output stages
- Signal generators and waveform-shaping circuits
- Data-converter and logic circuits

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course helps students to understand the principles of operation of analog integrated circuits and gives an introduction to the operation of logic integrated circuits.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Vladimir Fonoberov
	Graduate Assistant:	Jack Kao
Date:	June 1st, 2006.	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 105: Modeling and Simulation of Dynamic Systems

Course Description
Introduction to the mathematical modeling of dynamical systems and their methods of solution. Advanced techniques and concepts for analytical modeling and study of various electrical, electronic, and electromechanical systems based upon physical laws. Emphasis on the formulation of problems via different equations. Numerical methods for integration and matrix analysis problems. Case Studies. Digital computer simulation.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, elective.

Prerequisite(s)
CS 010, EE1A, MATH 046.

Textbooks and Related Materials
G. Modeling and Analysis of Dynamic Systems by Close, Frederick, and Newell, John Wiley, Third ed., 2002.
H. Dynamic Systems: Modeling and Analysis by Vu and Esfandiara
I. Modeling and Simulation of Dynamic Systems by R. L. Woods and K. L. Lawrence
J. Dynamic Modeling and Control of Engineering Systems by Shearer, Kulakowski, and Gardner

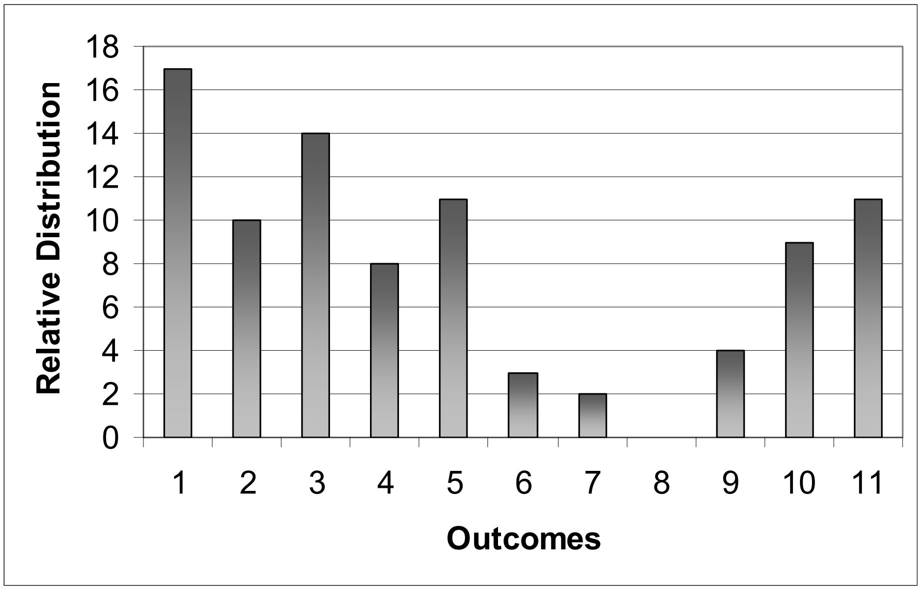
Course Objectives
This course focuses on the *development* and *numerical solution* of ordinary differential equations to describe the dynamic behavior of physical systems. Labs are coordinated with the lectures to exercise the lecture material. In class participation is encouraged and will be prompted if necessary.

Topics
- Systems introduction, Electrical systems
- Vectors, Matrices, Operations, Inverse Definition
- Eigenvalues, Eigenvectors, Similarity, Matrix Exponential
- Simulation State Space
- Mechanical systems
- Fluid systems
- Thermal systems
- System response

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course introduces students to methods for deriving models for dynamic systems, to methods for analysis of system models, and to state of the art methods and software tools for simulation analysis.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Jay Farrell
	Graduate Assistant:	Jack Kao
Date:	May 9th, 2006.	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 110A: Signals and Systems

Course Description
Basic signals and types of systems, linear time-invariant (LTI) systems, Fourier analysis, frequency response, and Laplace transforms for LTI systems. Laboratory experiments with signals, transforms, harmonic generation, linear digital filtering, and sampling/aliasing.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
CS 010, EE1B (may be taken concurrently).

Textbooks and Related Materials
- A.V. Oppenheim and A.S. Willsky, *Signals and Systems*, 2nd edition, Prentice-Hall, 1997.
- S. Haykin and B. van Veen, *Signals and Systems*, Wiley & Sons, 1999.
- H.P. Hsu, *Applied Fourier Analysis*, HBJ College Outline Series, HBJ, 1984.
- Mathworks, *The Student Edition of MATLAB*, Prentice-Hall, latest edition.

Course Objectives
10. In one or two sentences explain what are signals, systems, and system characterizations including linearity, causality, stability, time-invariance.
11. Determine system types and properties based on definitions.
12. Calculate system's response via convolution. Perform numerical computation using MATLAB.
13. Calculate Fourier series analysis. Generate harmonics and periodic waveforms using MATLAB.
14. Calculate Fourier transform. Perform numerical computation using MATLAB. Understand AM modulation and basic signal transmission concepts.
15. Conduct frequency domain analysis and realization. Perform signal manipulation and filter design.
16. Calculate Laplace transforms. Use Laplace transforms for system analysis.
17. Understand and can explain the basic concepts and utilities of filters.

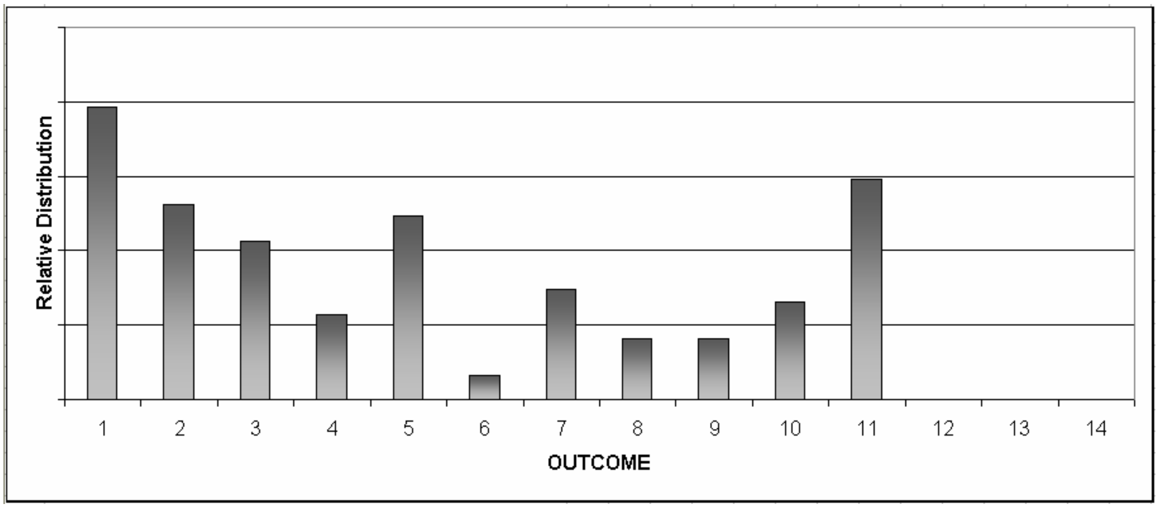
Topics
- Introduction and Review (Appendix, and Supplemental Materials): Introduction, review of complex numbers and complex functions, partial fraction expansion.
- General Concepts of Signals and Systems (Chap. 1): Typical class of signals, typical class of systems, important concepts and properties.
- LTI Systems (Chap. 2): Time domain representation, convolution, impulse response, causality and stability, linear ordinary differential equations, realization.
- Fourier Analysis (Chap. 3, Chap. 4): Frequency response of LTI systems, Fourier series, Fourier transforms and properties, convolution theorem.
- Frequency Domain Analysis (Chap. 6): Frequency response revisit, transfer functions and realization, Bode plots, first and second order systems, filter basics (tentative).
- Laplace Transformation (Chap. 9): Laplace transform, region of convergence, properties of Laplace transforms, typical Laplace transform pairs, inverse Laplace transformation, application to system analysis.

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

This course introduces the students some basic knowledge about continuous-time signals and systems, and provides some powerful tools, such as Fourier series, Fourier transform, Laplace transform etc., to analyze continuous-time LTI systems. Students will also be trained in lab experiments to use MATLAB to do systems analysis.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Peilin Fu
	Graduate Assistant:	Jack Kao

Date: May 2nd, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 110B: Signals and Systems

Course Description
Fourier analysis for discrete-time signals and systems, filtering, modulation, sampling and interpolation, z-transforms. Laboratory experiments with signals, transforms, harmonic generation, linear digital filtering, and sampling/aliasing.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
EE 110A.

Textbooks and Related Materials
- A.V. Oppenheim and A.S. Willsky, *Signals and Systems*, 2nd edition, Prentice-Hall, 1997.
- S. Haykin and B. van Veen, *Signals and Systems*, Wiley & Sons, 1999.
- H.P. Hsu, *Applied Fourier Analysis*, HBJ College Outline Series, HBJ, 1984.
- Mathworks, *The Student Edition of MATLAB*, Prentice-Hall, latest edition.

Course Objectives
1. Demonstrate competence in explaining what are discrete-time signals, and discrete-time systems and their characterizations including linearity, causality, stability, time-invariance.
2. Describe and analyze discrete-time system types and properties.
3. Demonstrate competence in calculating discrete-time system's response via convolution; and in performing numerical computations using digital signals.
4. Demonstrate competence in calculate Fourier series for discrete-time signals and in generating harmonics and periodic signals using MATLAB.
5. Ability to calculate Fourier transforms for discrete-time systems and perform numerical computation using MATLAB.
6. Ability to conduct frequency domain analysis and realization, and to perform signal manipulation and filter design for discrete-time signals.
7. Ability to calculate Z- transforms and to use Z- transforms for system analysis and design.

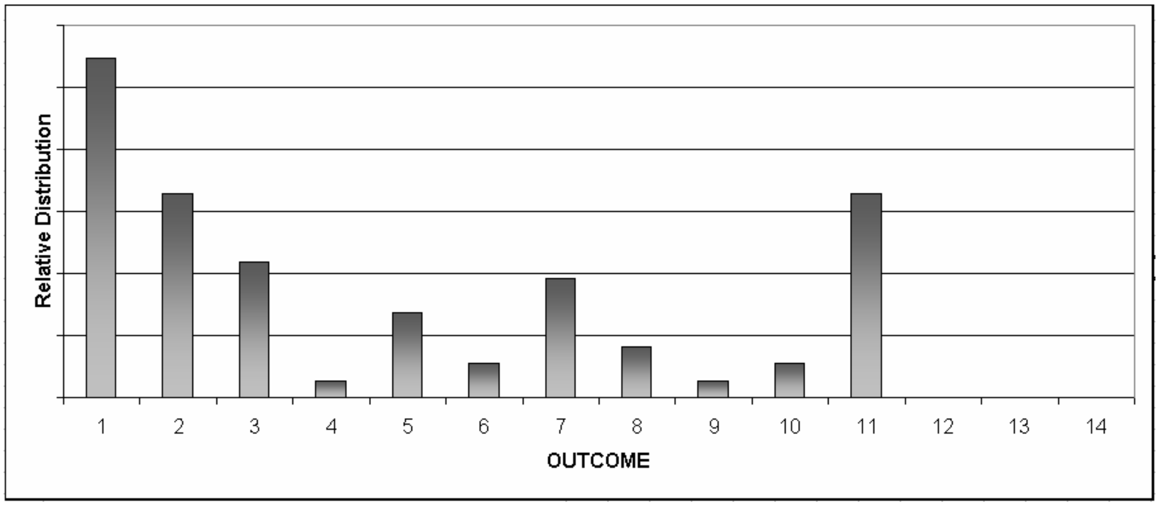
Topics
- General Concepts of Discrete-Time Signals and Systems (Chap. 1): Typical class of signals, typical class of systems, important concepts and properties.
- Discrete-Time LTI Systems (Chap. 2): Time domain representation, convolution, impulse response, causality and stability, linear ordinary difference equations, realization.
- Fourier Analysis (Chap. 3, 5): Fourier series for discrete-time signals, properties of Fourier series, Fourier transform for discrete-time signals, properties of Fourier transform, frequency domain analysis, solution of difference equations, transfer function and realization, Bode plots.
- Z transforms with applications (Chap. 10): Z-transform and properties, analysis of discrete-time LTI systems using Z-transform, solution of differential equations, bilateral Z-transform.
- Filters (Chap. 6) Ideal frequency selective filters, time-domain characteristics of ideal filters, lowpass and bandpass filters, discrete-time filters.
- Sampling (Chap. 7) The sampling theorem, ideal sampling and zero order hold, interpolation and signal reconstruction.

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

This course introduces the students some basic knowledge about discrete-time signals and systems, and provides some powerful tools, such as Fourier series, Fourier transform, Z transform etc., to analyze discrete-time LTI systems. Students will also be trained in lab experiments to use MATLAB to do systems analysis.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Peilin Fu
Graduate Assistant: Jack Kao

Date: May 2nd, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Fall 2005

EE 115: Introduction to Communication Systems

Course Description
Spectral density and correlation, modulation theory, amplitude, frequency, phase and analog pulse modulation and demodulation techniques, signal-to-noise ratios, and system performance calculations. Laboratory experiments in techniques of modulation and demodulation.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, elective.

Prerequisite(s)
EE 001B, EE110B.

Textbooks and Related Materials
- B. P. Lathi, Modern Digital and Analog Communication Systems, 3rd Ed.; Oxford Univ. Press, 1998 (ISBN 0-19-511009-9).
- Simon Hayking, Communication Systems, Wiley, 4th Edition, 2001 (ISBN 0-471-17869-1).
- Leon W. Couch, digital and Analog Communication Systems. Macmillan Publishing Co., 4th Edition, 1993.

Course Objectives
1. Briefly explain what are: Energy and Power spectral density, Bandwidth, Amplitude modulation; Frequency and Phase modulation. Design of modulators and demodulators;· Sampling theorem.
2. Design of modulators and demodulators; sampling theorem.
3. Plot Fourier power spectral density of a signal. Calculate the first-null bandwidth of base band signals.
4. Estimate power spectral density of a signal. Low pass and band pass filtering of various frequency components of a signal.
5. Design of modulators for AM and DSB-SC signals.
6. Design of demodulators for AM and DSB-SC signals in software and hardware. Frequency-division multiplexing.
7. Design modulators and demodulators for phase-modulated and frequency-modulated signals.
8. Calculate and analyze signals from their samples by determining the Nyquist sampling rate. Time-division multiplexing.
9. Learn and use MATLAB for communication systems.

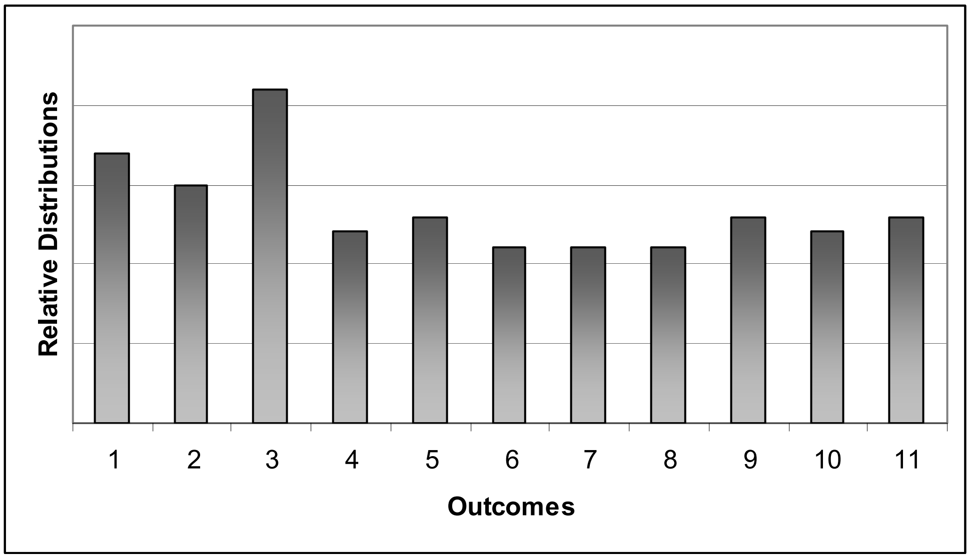
Topics (Section numbers are from textbook A. Sections marked **bold** give the most important material)

- *Introduction and Review*: Transmission media (sect. 9.3). Communication system (Sect. 1). Modulation (Sect. 1). **Fourier transform and series.** (2.4, 2.8-2.10, 3.1-3.3). **Energy spectral density. Bandwidth** (3.7)**.**
- *Introduction to performance analysis*: **Power spectral density and autocorrelation analysis** (3.8).
- *Amplitude modulation*: **Suppressed carrier (DSB), Large carrier (AM)**. Frequency division multiplexing. (Sect. 4.1-4.4, 4.7)
- *Angle modulation*: **Frequency and phase modulation. Bandwidth of narrowband and wideband modulation**. (5.1-5.2). **Generation** and demodulation **of FM waves** (5.3, 5.4).
- *Sampling:* Transmission through linear systems (3.4-3.6). **The sampling theorem, the rate of pulse transmission** (6.1).

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
EE115 provides students the basic knowledge of communication systems. Students will learn to use commercial Matlab software to design, analyze, and test communication systems. Students will work as a team during the lab section to prepare them to collaborative work in engineering teams.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Ilya Dumer
Graduate Assistant: Jack Kao

Date: April 27th, 2006

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 120A: Logic Design

Course Description
Design of digital systems. Topics include Boolean algebra; combinational and sequential logic design; design and use of arithmetic-logic units, carry-lookahead adders, multiplexors, decoders, comparators, multipliers, flip-flops, registers, and simple memories; state-machine design; and basic register-transfer level design. Laboratories involve use of hardware description languages, synthesis tools, programmable logic, and significant hardware prototyping. Cross-listed with CS/EE 120A.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
CS 061.

Textbooks and Related Materials
K. Prof. Frank Vahid, “Digital Design”, Preview Ed., (Prof Vahid will not receive any royalty from the sale of this text book)
L. Mano and Kime, “Logic and Computer Design Fundamentals and Xilinx Student Edition 4.2 Package”, 3rd ed.

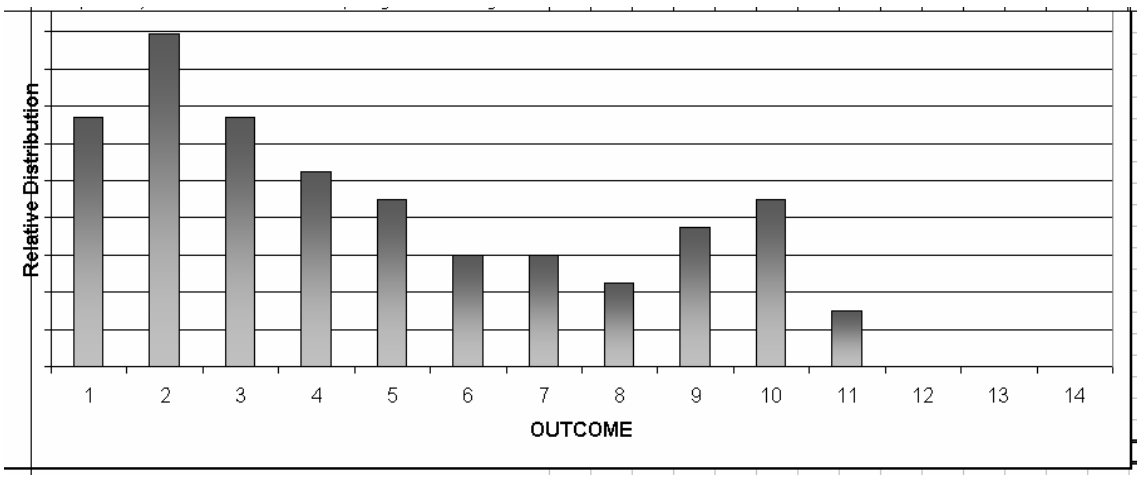
Course Objectives
9. Able to perform the conversion among different number systems; familiar with basic logic gates – AND, OR & NOT, XOR, XNOR; independently or work in team to build simple logic circuits using basic.
10. Understand Boolean algebra and basic properties of Boolean algebra; able to simplify simple Boolean functions by using the basic Boolean properties.
11. Able to design simple combinational logics using basics gates. Able to optimize simple logic using Karnaugh maps, understand “don’t care”.
12. Familiar with basic sequential logic components: SR Latch, D Flip-Flop and their usage and able to analyze sequential logic circuits.
13. Understand finite state machines (FSM) concept and work in team to do sequence circuit design based FSM and state table using D-FFs.
14. Familiar with basic combinational and sequential components used in the typical datapath designs: Register, Adders, Shifters, Comparators; Counters, Multiplier, Arithmetic-Logic Units (ALUs), RAM. Able to do simple register-transfer level (RTL) design.
15. Able to understand and use one high-level hardware description languages (VHDL or Veriliog) to design combinational or sequential circuits.
16. Understand that the design process for today’s billion-transistor digital systems becomes a more programming based process than before and programming skills are important.

Topics
- Number systems, Combinational logic circuits, Digital systems, Combinational design
- Sequential logic concept and analysis, Flip-flops, Optimization in sequential design
- Datapath components, ALU
- Register-transfer level design, RAM design
- IC Design, programming IC technologies

Class/laboratory Schedule
Lecture 3 hours; laboratory, 6 hours.

Course Contribution to Professional Component
This course allows students to understand the internal design of computer processors and to practice in design and optimization of logic circuits both theoretically and experimentally.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Vladimir Fonoberov
	Graduate Assistant:	Jack Kao
Date:	May 1st, 2006	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Fall 2005

EE 128: Data Acquisition, Instrumentation, and Process Control

Course Description
Analog signal transducers, conditioning and processing; step motors, DC servo motors, and other actuation devices; analog to digital and digital to analog converters; data acquisition systems; microcomputer interfaces to commonly used sensors and actuators; design principles for electronic instruments, real time process control and instrumentation.

Course Type (Required or Elective)
Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)
CS 120A/EE 120A, EE 100B; or consent of instructor.

Textbooks and Related Materials
- Gordon Doughman, "Programming the Motorola M68HC12 Family", Publisher: Annabooks (www.annabooks.com), ISBN: 0-929392-67-1, First Printing, 2000
- G. Jack Lipovski, "Single- and Multi-Chip Microcontroller Interfacing for the Motorola 68HC12", Academic Press Series in Engineering, 1999, ISBN: 0-12-451830-3.
- D. Pack & S. Barrett, "68HC12 Microcontroller, Theory and Applications", Prentice Hall, 2002, ISBN 0-13-033776-5.
- J. Peatman, "Design with Microcontrollers", McGraw-Hill, 1988.
- Motorola, "MC9S12DP256 Reference Manual", 2002.
- miscellaneous documents in support of 9S12 evaluation board.

Course Objectives
- Ability to implement Boolean logic in software; includes techniques on how to read and write bit-level memory;
- Ability to understand and design general architectures of a microcontroller-based digital system and their application to real-time process control;
- Form fundamental understanding of a bus-architecture system and be able to interface memory and peripheral hardware within;
- Ability to understand how interrupts work within microprocessor/microcontroller systems; design a process control system using interrupts;
- Understand fundamentals of sequence- and state-machines and learn how to implement a process as a sequence- or state-machine;
- Learn principles of digital-to-analog and analog-to-digital conversion and techniques of implementation;
- Learn principles of serial & parallel communications, timers & counters (e.g., output compares, input captures, pulse accumulation) and techniques of implementation;
- Ability to understand how a variety of sensors and actuators can be interfaced to a microcontroller system; key emphasis is on the design of interface circuitry.

Topics

- Programmed logic
- Microcontroller-based digital systems
- Bus architecture and interfacing
- Interrupt handling
- Digital-to-analog, analog-to-digital conversion techniques
- Serial and parallel communication interfaces
- Timers and counters
- Sensors, actuators, steppers and DC servo motors
- Data acquisition and instrumentation

Class/laboratory Schedule

Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

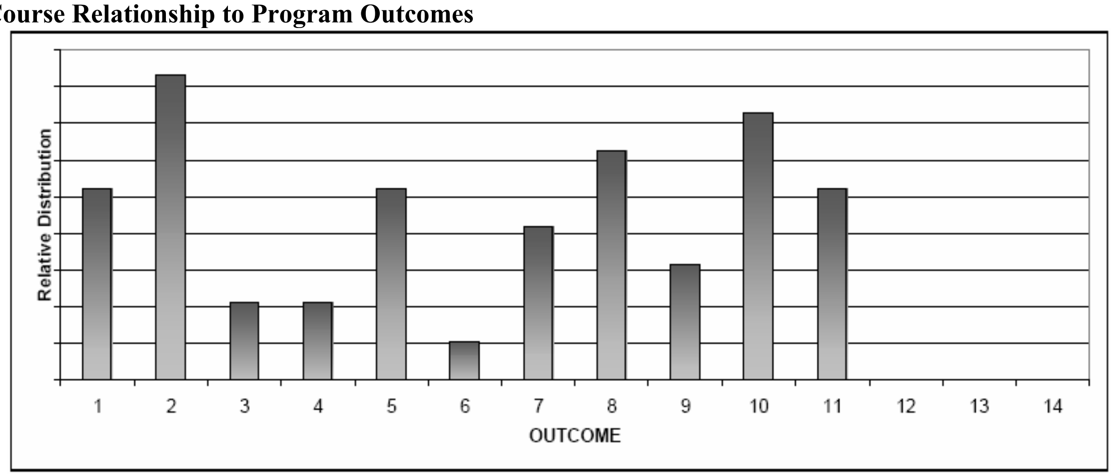
This course satisfies the ABET guideline of providing:

(a) one quarter of college-level mathematics and engineering with a large emphasis on experimental experience;

(b) one quarter of an important engineering topic dealing with instrumentation and embedded systems; and

(c) a general education component focus on design.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Matt Barth
Graduate Assistant: Jack Kao

Date: April 27th, 2006

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 132: Automatic Control

Course Description
Covers mathematical modeling of linear systems for time and frequency domain analysis. Topics include transfer function and state variable representations for analyzing stability, controllability, and observability; and closed-loop control design techniques by Bode, Nyquist, and root-locus methods. Laboratories involve both simulation and hardware exercises.

Course Type (Required or Elective)
Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)
EE 105 or ME 103 or equivalent; EE 110A or ENGR 118; or consent of instructor.

Textbooks and Related Materials
C. Dorf and R. H. Bishop, Modem Control Systems, 10^{th} Edition, Prentice-Hall, 2005.

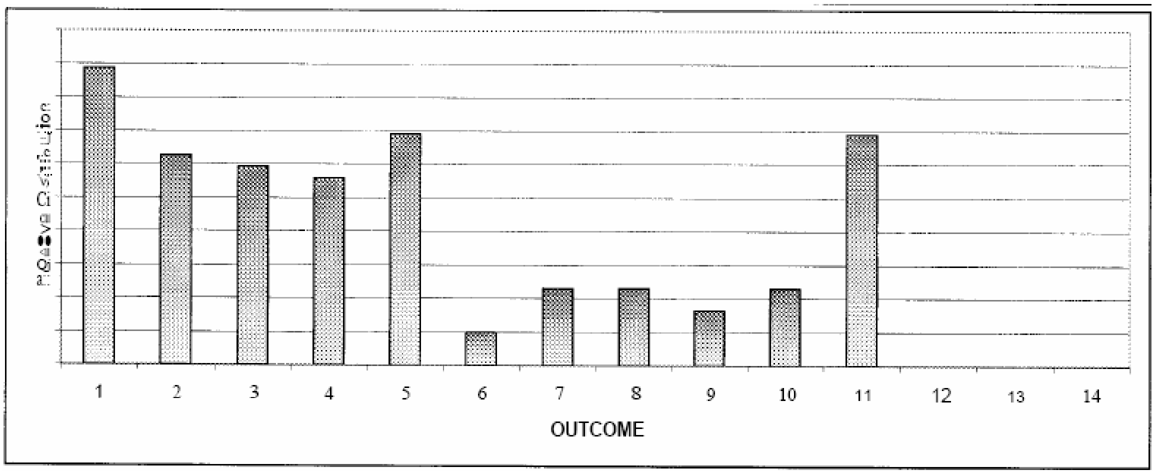
Course Objectives
An introduction to the design and analysis of control systems.

Topics
- Introduction to control systems
- Modeling second order systems
- Useful Laplace transform properties
- Transfer function and frequency responses.
- Block diagram manipulations
- Control charactersistics
- Transient response vs. pole locations, time domain specs
- Steady state tracking & system type
- Routh-Hurwitz criteria
- Root locus theory & examples
- Root locus & PID control
- Frequency response
- Nyquist stability criterion
- Lead compensation
- Lag compensation

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course provides the students basic knowledge and techniques about modeling, analysis and design of control systems in both time domain and frequency domain. A lot of practical control systems examples and homework problems give the students good training to apply the techniques, skills, and engineering tools to engineering practice. The students can also get some experiences on software simulation and hardware manipulation through lab experiments.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Peilin Fu
Graduate Assistant: Jack Kao

Date: May 24th, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 140: Computer Visualization

Course Description
Visual perception and thinking, operations on digital images, shaded pictures, perspective transformation, picture generation using solid polyhedra, illumination and color models, ray tracing, special effects and animations. Laboratories on visual realism methods: dithering, halftoning, 3-D viewing, and rendering.

Course Type (Required or Elective)
Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)
CS 130

Textbooks and Related Materials:
Introductory Techniques for 3D Computer Vision, E. Trucco and A. Verri, Prentice Hall.
Computer Graphics, D. Mount, http://www.cs.umd.edu/~mount/427/Lects/427lects.pdf
Handouts given in class on rotation matrices, illumination models and 3D geometry.

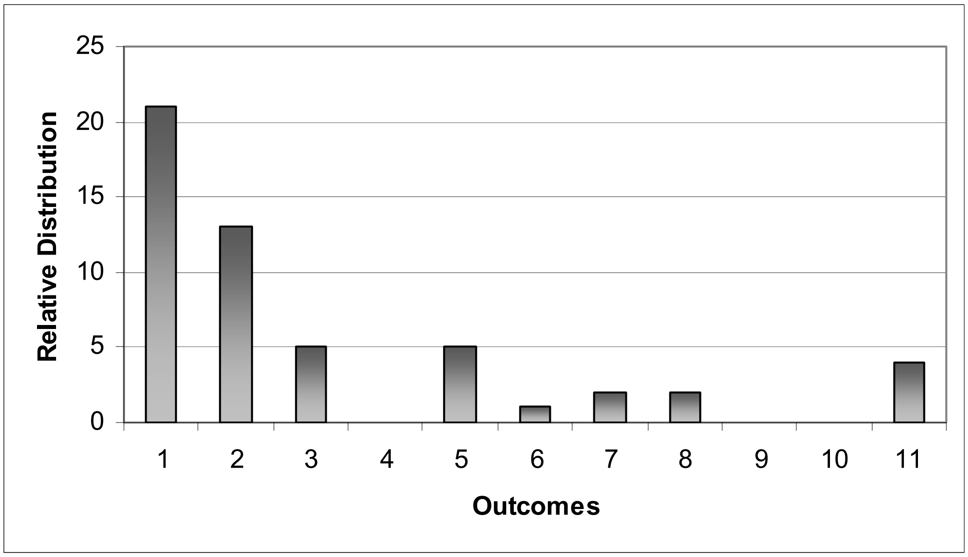
Course Objectives
1. Understand the various problems in visualization and the tools required for solving the problems.
2. Understand the role of image processing, computer vision and computer graphics in 3D modeling.
3. Perform low level image processing tasks like edge detection, segmentation and registration.
4. Estimate 3D models using low level image cues.
5. Understand the mathematical derivations in 3D model estimation.
6. Understand the practical limitations of 3D model estimation techniques.
7. Build, render and animate 3D models using motion, stereo and illumination information.
8. Perform an independent study on one of the topics in the course, complete a small project and present the research.

Topics
- Course Overview. Introduction and Biological Vision Systems
- Low-level image processing
- Tracking – Flow and Features
- Rotation Matrices.
- Optics and Radiometry
- Image Formation, Color Spaces, Dithering, Halftoning
- Image Noise Models
- Camera Models, Camera Parameters, Homogeneous Coordinates
- Stereo
- Motion in Video
- Image-based Lighting Models
- Lightfields
- Rendering
- Animation

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course provides the fundamentals for 3D modeling and visualization. For this purpose, it uses a number of concepts from college-level linear algebra and geometry. It also provides experience in computer programming.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Amit K. Roy Chowdhury
	Graduate Assistant:	Jack Kao

Date: April 27th, 2006

Department of Electrical Engineering
University of California
Riverside, CA 92521
Fall 2005

EE 141: Digital Signal Processing

Course Description
Transform analysis of Linear Time-Invariant (LTI) systems, discrete Fourier Transform (DFT) and its computation, Fourier analysis of signals using the DFT, filter design techniques, structures for discrete-time systems. Laboratory experiments on DFT, fast Fourier transforms (FFT), infinite impulse response (IIR), and finite impulse response (FIR) filter design, and quantization effects.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
EE 110B.

Textbooks and Related Materials
A. V. Oppenheim, R. W. Schafer, and J. R. Buck, Discrete-Time Signal Processing, 2nd edition, Prentice-Hall, 1999.
B. S. K. Mitra, Digital Signal Processing – A computer-based approach, 3rd edition, McGraw Hill, 2005.

Course Objectives
1. Ability to explain briefly such concepts as digital signal processing, digital filter, DFT, FFT, stability, causality, frequency response, impulse response, sampling, Nyquist rate, etc.
2. Ability to carry out lab experiments using MATLAB to solve DSP problems as well as the ability to perform teamwork, independent thinking and report writing.
3. Ability to design and analyze FIR and IIR filters.
4. Ability to design and analyze A/D and D/A converters.
5. Ability to compute and analyze DTFT, DFT and FFT of signals.
6. Ability to analyze and apply Z-transforms and inverse Z-transforms.
7. Ability to use signal block diagrams and signal flow graphs to represent DSP systems as well as the ability to understand systems in such forms.
8. Ability to design and analyze DSP systems from sampling, A/D and all the way to D/A.

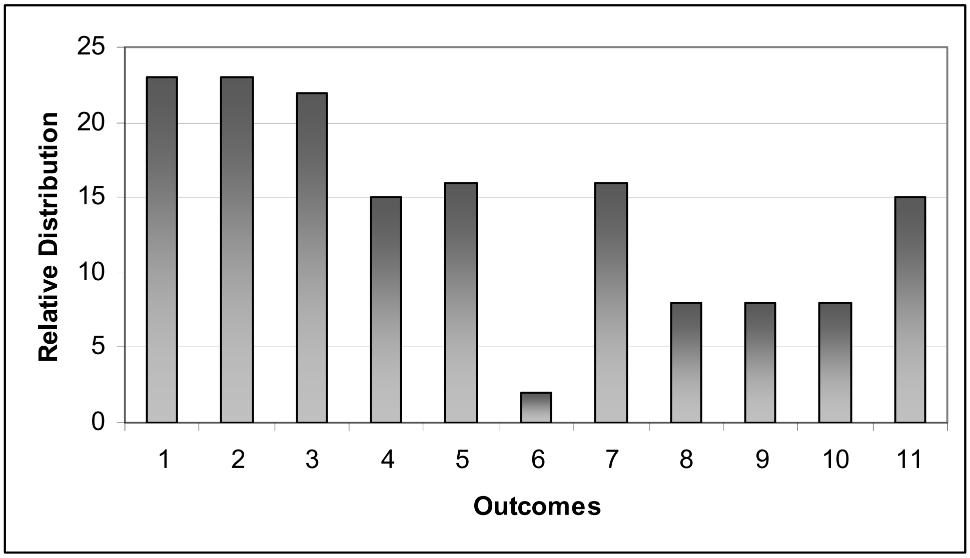
Topics
- Discrete-time signals and systems
- Z-transform
- Sampling of continuous-time signals
- Transform analysis of linear time-invariant (LTI) systems
- Structures for discrete-time systems
- Filter design
- Discrete Fourier transform (DFT)
- Computation of DFT
- Fourier analysis of signals using DFT
- Discrete Hilbert transform

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

EE141 prepares students in the area of digital signal processing that is important for telecommunications, computer engineering and electrical engineering. Students learn from this course techniques of discrete-time signal and system representation, analysis and design.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Yingbo Hua
	Graduate Assistant:	Jack Kao
Date:	April 28th, 2006	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 144: Introduction to Robotics

Course Description
Basic robot components from encoders to microprocessors. Kinematic and dynamic analysis of manipulators. Open-and closed-loop control strategies, task planning, contact and non-contact sensors, robotic image understanding, and robotic programming languages. Experiments and projects include robot arm programming, robot vision, and mobile robots.

Course Type (Required or Elective)
Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)
EE 132.

Textbooks and Related Materials
J. Craig, Introduction to Robotics: Mechanics and Control, 3rd Ed. Addison Wesley

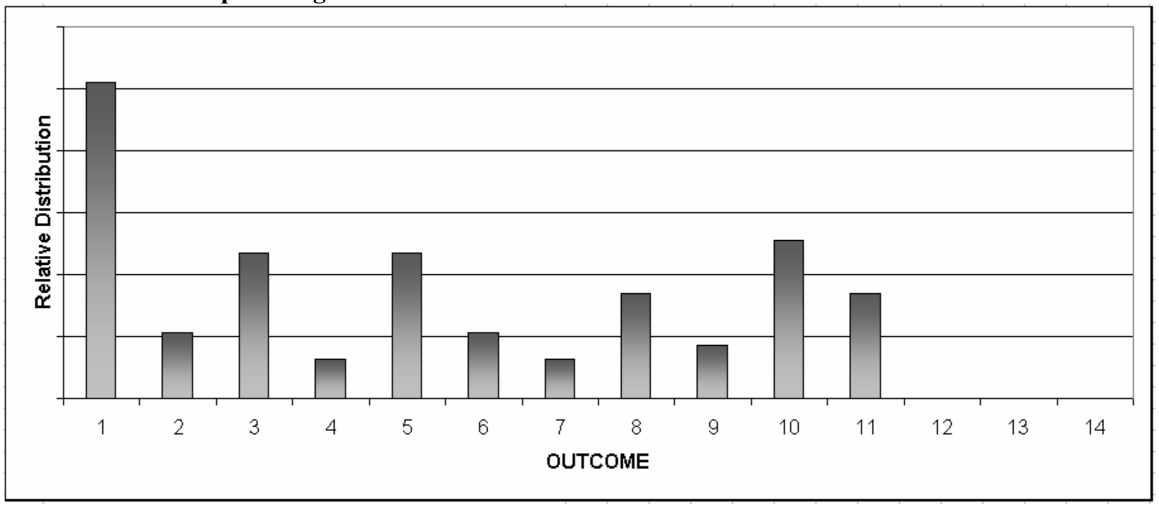
Course Objectives
1. Demonstrate competence in robotic components -- sensors
2. Describe and analyze position/orientation using T matrices
3. Demonstrate competence in analyzing kinematic equations of robot motion
4. Demonstrate competence in analyzing inverse kinematics of industrial manipulators
5. Demonstrate competence in obtaining solutions to robot dynamics
6. Describe analyze and design trajectory control
7. Describe analyze and design force control
8. Demonstrate ability in designing experiments in above topics

Topics
1. Spatial descriptions and transformations
2. Manipulator kinematics
3. inverse manipulator kinematics
4. Jacobians: velocities and static forces
5. Manipulator dynamics
6. Trajectory generation
7. Linear control of manipulators
8. Non-linear control of manipulators
9. Force control of manipulators
10. Robot programming
11. Lab projects (tentative): programming of robot-arm with vision; programming of mobile robot with vision and other sensors

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course prepares students for careers in manufacturing areas, robotics, mechatronics, and a vast range of industries where advanced automation is used.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Gerardo Beni
	Graduate Assistant:	Jack Kao

Date: June 20th, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 146: Computer Vision

Course Description
Imaging formation, early vision processing, boundary detection, region growing, two-dimensional and three-dimensional object representation and recognition techniques. Experiments for each topic are carried out.

Course Type (Required or Elective)
Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)
Senior standing in Computer Science or Electrical Engineering, or consent of instructor.

Textbooks and Related Materials
- L. Shapiro and G. Stockman, "Computer Vision," Prentice Hall 2001
- O. Faugeras, "Three-Dimensional Computer Vision – a Geometric Viewpoint," MIT Press, 1993.
- D.A. Forsyth and J. Ponce, "Computer Vision – A Modern Approach," Prentice Hall 2003.
- M. Bennamoun and G.J. Mamic, "Object Recognition – Fundamentals and Case Studies," Springer 2002.
- R. Jain, R. Kasturi and B.G. Schunck, "Machine Vision," McGraw-Hill, Inc. 1995.
- W.E.L. Grimson, "Object Recognition by Computer: The Role of Geometric Constraints," The MIT Press, 1990.
- R. Haralick and L. Shapiro, "Computer and Robot Vision," Vol. 1 (1992) and Vol. 2 (1993) Addison Wesley.

Course Objectives
1. Understand goals of computer vision, its applications, image formation model, image representation and operations on images
2. Learn imaging devices, image types and formats, sampling/quantization and notations for algorithms, count foreground objects using internal and external corners.
3. Learn thresholding, connected component algorithms, binary image morphology and features of connected components.
4. Understand principles of pattern recognition systems, feature representation, k-NN classifier, Bayesian decision making, precision/recall, confusion matrix and recognition of 2D objects.
5. Perform filtering in spatial and frequency domain, Gaussian filtering, edge detection, convolution/correlation and noise removal.
6. Learn color models, color histogram and color image segmentation using K-means algorithm. Texture and its texel-based description, texture features.
7. Learn basics of content-based image retrieval, image databases, queries by example, image distance measures and indexing.
8. Estimate motion from 2D image sequences by performing feature correspondence, compute motion vectors and track objects.
9. Detect curves in images, Use Hough transform to detect lines in images.

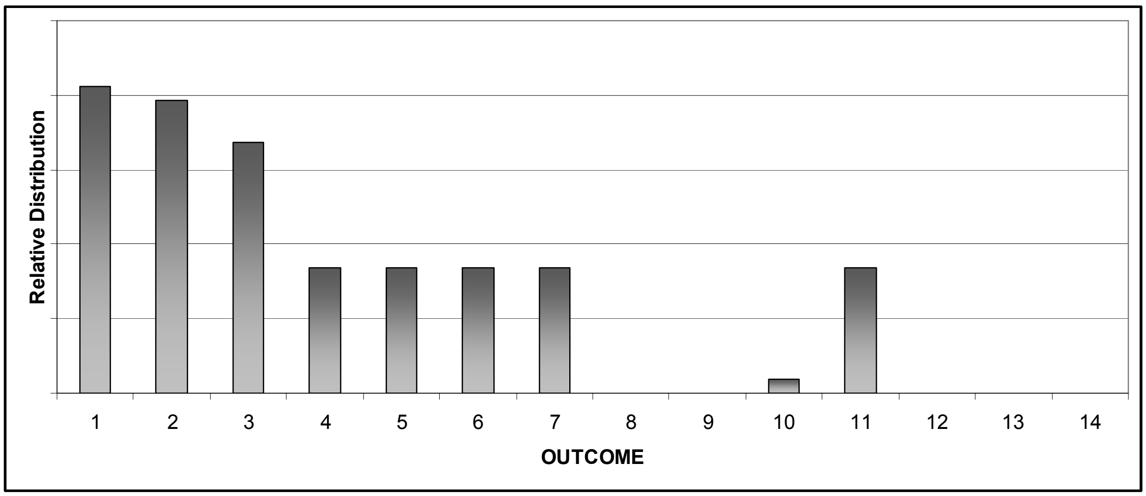
Topics
- Introduction
- Imaging and Image Representation
- Binary Image Analysis
- Pattern Recognition Concepts
- Filtering and Enhancing Images

- Color and shading
- Texture
- Content-based Image Retrieval
- Motion from 2D Image Sequences
- Image Segmentation

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course introduces the field of computer vision to students. Topics include image formation process, imaging devices, connected component labeling algorithms, image morphology, thresholding, image segmentation, color models, texture and motion analysis, content-based retrieval and 2-object recognition. The students learn how to write pseudocode and programs for algorithms; they perform a relevant laboratory each week to reinforce the basic concepts discussed in the lectures.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Bir Bhanu
Graduate Assistant: Jack Kao

Date: May 31st, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 150: Digital Communication

Course Description
Topics include pulse code modulation, correlation and power spectra, equalization and coding methods, shift and phase keying, probability and random variables, errors of transmission, and a comparison of digital communication systems.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, elective.

Prerequisite(s)
EE115

Textbooks and Related Materials
A. B.P. Lathi. Modern Digital and Analog Communication Systems, 3rd ed., Oxford Uni. Press, 1998. (ISBN 0-19-511009-9).
B. Simon Haykin, Communication Systems, Wiley, 4th Edition, 2001 (ISBN 0-471-7869-1).
C. Leon W. Couch, Digital and Analog Communication Systems, 4th ed. Macmillan Publ. Co., 1993.

Course Objectives
1. In one or two sentences explain what are: Data Transmission and compression, Deterministic and random signals; Autocorrelation, Bandwidth of random signals; Pulse-code modulation. Signal-to-noise ratio, Bandwidth-noise trade offs; Line coding; Nyquist criteria, IS interference (ISI), Transmission and quantization errors; Error probability; The means and variances of random variables; Gaussian and Poisson distributions, Central limit theorem; Matched Filter.
2. Calculate the frequency response and power spectral density of basic low-pass and band-pass signals. Time-bandwidth trade offs
3. Analysis of quantization noise : quantatative bandwidth-noise trade offs
4. Calculate the autocorrelation of basic random signals (polar signaling). Time-bandwidth trade offs
5. Calculate the autocorrelation of advanced random signals (Manchester, bipolar, duobinary signaling). Time-bandwidth trade offs
6. Analysis of pulse code modulation: quantative bandwidth-noise-complexity trade offs
7. Analysis of ISI and Nyquist criteria
8. Analysis of random variables, their sums and distributions in communication design
9. Analysis of PCM systems corrupted by both quantization and channel noise

Topics (Section numbers are from textbook A. Sections marked **bold** give the most important basic material. Sections marked *italic* represent auxiliary or advanced material for extra reading)

<u>**Introduction and Review**</u>: Overview of Communication systems (Ch. 1,2). **Fourier transform and series.** (2.4, 2.8-2.10, 3.1-3.3). **Energy - and Power Spectral Density (3.6-3.8).** Time-Bandwidth product. **Sampling theorem (6.1). Bandwidth and transmission rate.**

<u>**Pulse Code modulation**</u>: **Sampling and Quantizing. Quantization Noise. Signal-to-noise ratio (SNR) and the Bandwidth.** μ-law and A-law**.** Digital multiplexing (6.2). **Line Coding. Polar, Unipolar, Bipolar, Duobinary, and Manchester Signaling (7.2).**

Intersymbol interference (ISI). Pulse shaping. Nyquist criteria for Zero ISI (7.4). *Differential Coding, Delta modulation and overloading (6.3, 6.4). Eye diagrams (7.5).* Detection error probability (7.6). M-ary Communication (7.7, 7.8).

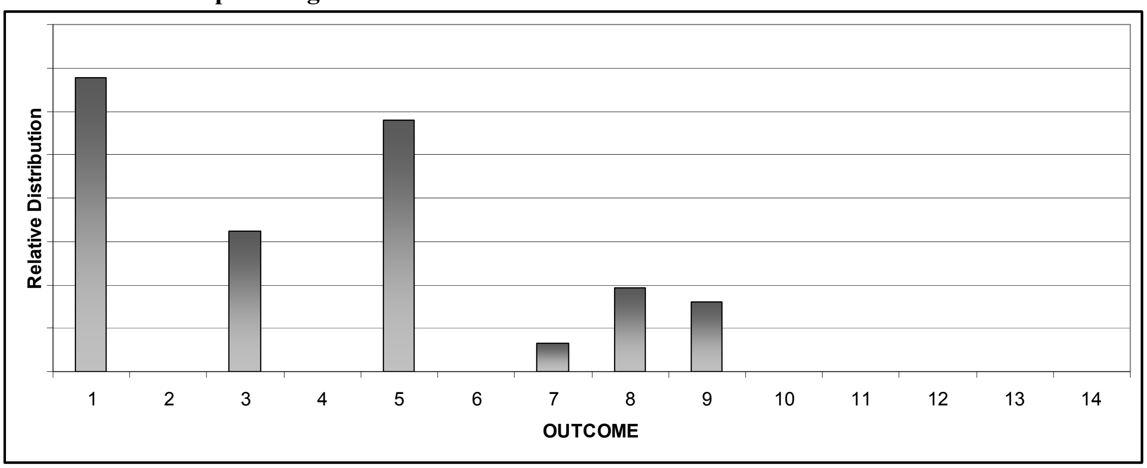
<u>Probability Theory as a Tool for analysis in Noisy Communications</u>: Events, Venn diagrams. Conditional Probability and Independent Events (10.1). Random Variables, Cumulative Distribution Function, Probability Density Function. Channel models. Threshold detection **(10.2).**

Statistical Averages (Means). Variance. Binomial, Gaussian, and Poisson Distributions. The mean error of the Quantization Noise and the Channel Noise (10.3). *Chebyshev inequality and the Central Limit Theorem (10.4,10.5). Introduction to matched filter.*

Class/laboratory Schedule
Lecture, 3 hours; discussion, 1 hour.

Course Contribution to Professional Component
EE150 provides important skills required to analyze communication systems. The course trains students to solve design problems related to communication system. It requires a significant use of college-level mathematics in Calculus, Probability Theory, and Statistics.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Ilya Dumer
Graduate Assistant: Jack Kao

Date: April 27th, 2006

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 151: Introduction to Digital Control

Course Description
Review of continuous-time control systems; review of Z-transform and properties; sampled-data systems; stability analysis and criteria; frequency domain analysis and design; transient and steady-state response; state-space techniques; controllability and observability; pole placement; observer design; Lyapunov stability analysis. Laboratory experiments complementary to these topics include simulations and hardware design.

Course Type (Required or Elective)
Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)
EE 132, EE141.

Textbooks and Related Materials
K. Ogata, *Discrete Time Control Systems*, Prentice-Hall, 2nd Ed., 1995.

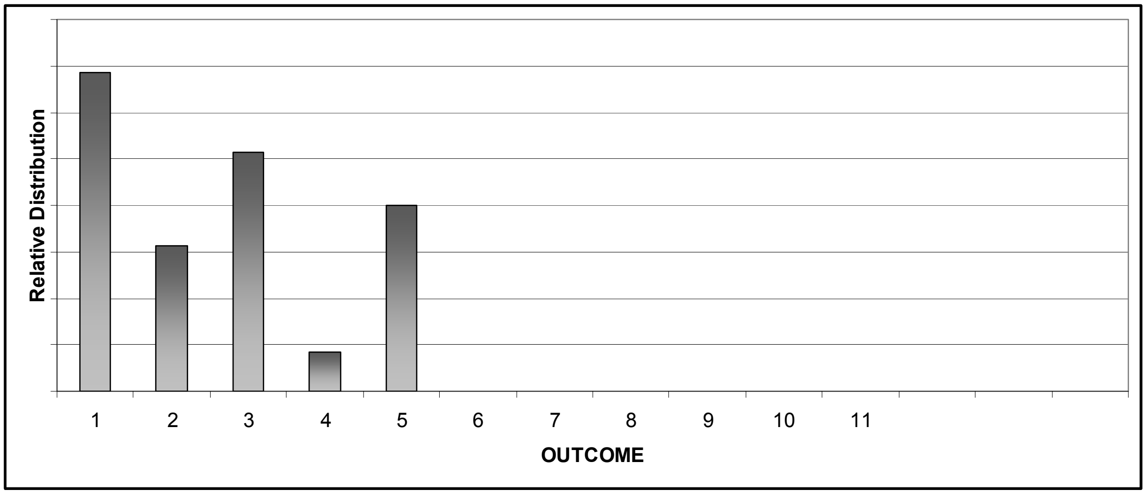
Course Objectives
1. Understand and be able to explain the advantage of digital control systems.
2. Be able to perform Z-transform of control system transfer function.
3. Understand the different classical methods for designing digital control systems.
4. Understand the state space method for designing digital control systems.
5. Be able to evaluate the stability of digital control systems.
6. Understand and be able to determine the gain and phase margins of digital control systems.
7. Learn how to calculate the controllability and observability of digital control systems in the state space representations.
8. Design a pole placement digital controller in the state space representation.

Topics
- Introduction to Digital Control Systems (Ch. 1)
- The Z-Transform (Ch. 2)
- Analysis of Discrete-Time Control Systems (Ch. 3)
- Classical Digital Control Designs methods (Ch. 4)
- Modern Digital Control Design Methods (Ch. 5-6)

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component
This course prepares students for a career in Digital control design and analysis by teaching theory and the tools to design digital control systems for several industrial applications. The students will be able to design control systems to meet a given design specifications/requirements using both classical and modern digital control methods. Students will be able to design digital control systems to meet both phase and gain margin requirements.

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Hossny El-Sherief
Graduate Assistant: Jack Kao

Date: May 25th, 2006.

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 152: Image Processing

Course Description

Digital image acquisition, image enhancement and restoration, image compression, computer implementation and testing of image processing techniques. Students gain hands-on experience of complete image processing systems, including image acquisition, processing, and display through laboratory experiments.

Course Type (Required or Elective)

Electrical Engineering, elective; Computer Engineering, elective.

Prerequisite(s)

EE 110B

Textbooks and Related Materials

A. R.C. Gonzalez and R. E. Woods, *Digital Image Processing*, 2nd Edition, Prentice Hall.
B. A. K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall.

Course Objectives

To convey the students basic knowledge about fundamentals of digital image processing, sampling, quantization, image transforms, image filtering, image enhancement and restoration, image compression, and color image processing. In addition, the students should be able to

a) compute and sketch the 2-dimensional (discrete or continuous) Fourier Transform of a given image,
b) find the most efficient 2-D sampling strategy to prevent aliasing in the digital representation,
c) design the memoryless transform to be applied to a given image for histogram equalization,
d) design image smoothing or sharpening filters taking into account the tradeoff between sharpness of the filter and the ringing effect,
e) apply inverse or Wiener filtering techniques to restore an image degraded and corrupted by noise,
f) convert the RGB representation of a given image to the HIS representation, and vice versa,
g) construct an image compression tool exploiting coding, spatial, and psychovisual redundancies.

Topics

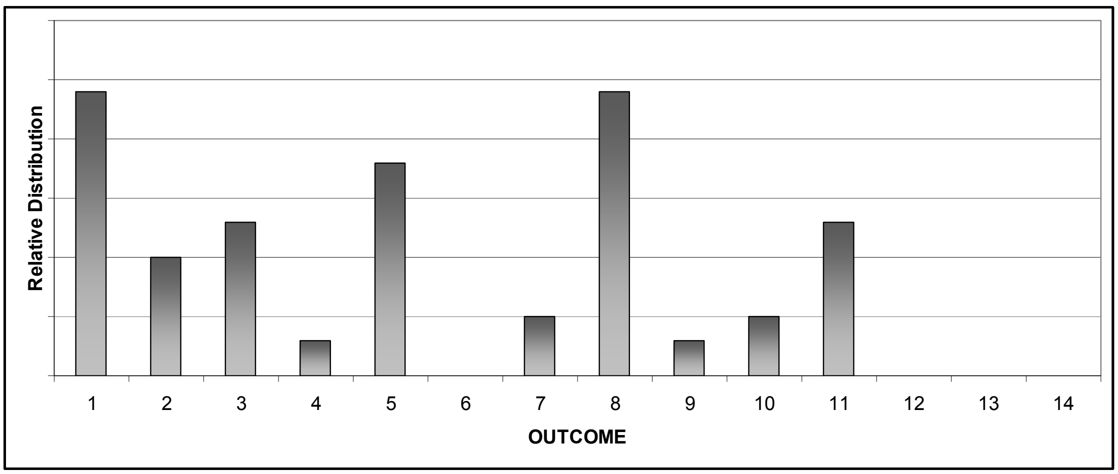
- Digital image fundamentals
- Image transforms
- Image enhancement
- Image restoration
- Color image processing
- Image compression

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

This course is a perfect combination of applied (college-level) mathematics and engineering. The students not only learn about real-life applications of some signal processing tools which are heavy in math, but also gain a lot of experimental experience in the lab portion.

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Ertem Tuncel
	Graduate Assistant:	Jack Kao
Date:	April 27th, 2006	

Department of Electrical Engineering
University of California
Riverside, CA 92521
Winter 2006

EE 175A: Senior Design Project

Course Description
Under the direction of a faculty member, students (individually or in small teams with shared responsibilities) build, test, and redesign electrical engineering devices or systems. Requires a written report and an oral presentation of the design aspects. Satisfactory (S) or No Credit (NC) grading is not available.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
Senior standing in Electrical Engineering.

Textbooks and Related Materials
N/A

Course Objectives
The Senior Design Project is the culmination of course work in the bachelor's degree program in electrical engineering. In this comprehensive two-quarter course, students are expected to apply the concepts and theories of electrical engineering to a novel research project. A written report, giving details of the project and test results, and an oral presentation giving the details of the project, will be required to complete this course satisfactorily.

Topics
Projects will be carried out in four different sections corresponding to the main electrical engineering areas taught at UCR. Each section will have a "section professor" (i.e., faculty supervisor) as designated below. Possible project topics are obtained from the section professor.

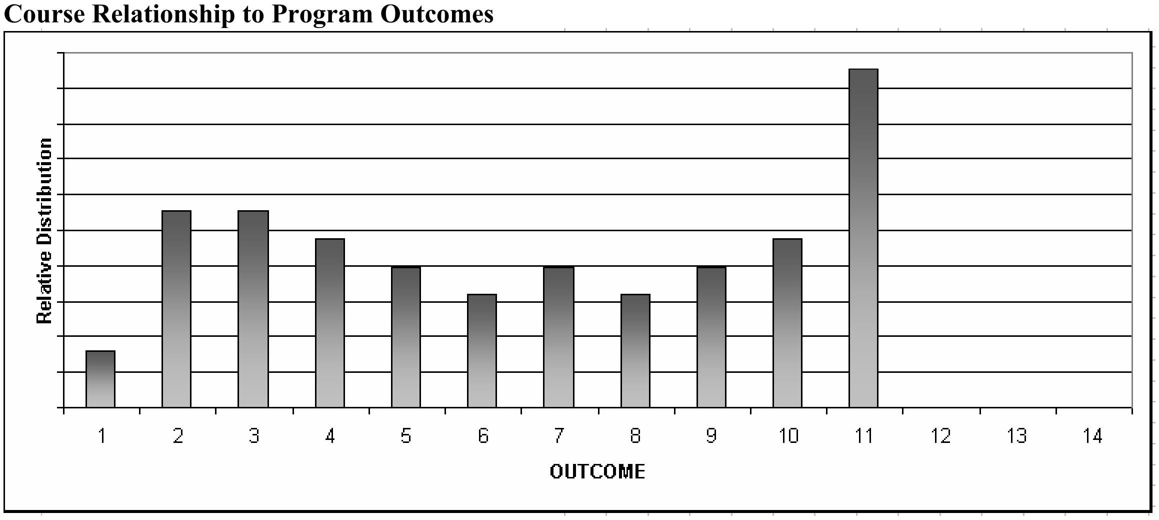
Electrical Engineering Area	**Section Professor**	**Topics**
Nano-Materials, Devices and Circuits (NMDC)	Mihri Ozkan	*Solarium Environment and Solar Cell Development* --- Students will build an environmental test chamber (i.e., Solarium) tha is capable of simulated sunlight at different intensities. The students will then fabricate organic solar cells and subsequently characterize these designs in the environmental test chamber.
Intelligent Systems (IS)	Matthew Barth	*Autonomous Vehicles* --- a variety of projects are offered focusing on various aspects of autonomous vehicle operation. Projects can span different platforms and applications, all the way from small micro-robots to larger electric vehicles. Projects will focus on sensors, vehicle control, navigation techniques, and integration. Example projects include micro-mouse, sumo robots, intelligent ground vehicle, and

		autonomous neighborhood electric vehicles.
Controls and Robotics (CR) (& Sensing)	Gerardo Beni and Amit Roy Chowdhury	*Controls and Systems* --- Students will work on various control, systems, and multi-media projects. Some projects will be offered with colleagues from the UCR music/performance department. *Image Processing* --- Other projects include face recognition, video based digital map design, and the synthesis of human activities using learned dynamical models.
Communications and Signal Processing (CSP)	Yingbo Hua, Ilya Lyubomirsky, and Sheldon Tan	*Ad Hoc Communication Networks* --- Projects include building and testing a network of three or more wireless nodes that can communicate with each other. Students will search and buy commercially available wireless transceivers and then design, develop, and implement communication protocols into the network. Students will demonstrate that their network can indeed perform communications among its nodes without assistance from any established base station.

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

Course Relationship to Program Outcomes



Prepared by:	Instructor:	Dr. Matthew Barth	Dr. Gerardo Beni
		Dr. Amit Roy Chowdhury	Dr. Yingbo Hua
		Dr. Ilya Lyubomirsky	Dr. Mihri Ozkan
		Dr. Sheldon Tan	
	Graduate Assistant:	Jack Kao	

Date:

Department of Electrical Engineering
University of California
Riverside, CA 92521
Spring 2006

EE 175B: Senior Design Project

Course Description
Under the direction of a faculty member, students (individually or in small teams with shared responsibilities) build, test, and redesign electrical engineering devices or systems. Requires a written report and an oral presentation of the design aspects. Satisfactory (S) or No Credit (NC) grading is not available.

Course Type (Required or Elective)
Electrical Engineering, required; Computer Engineering, required.

Prerequisite(s)
Senior standing in Electrical Engineering.

Textbooks and Related Materials
N/A

Course Objectives
The Senior Design Project is the culmination of course work in the bachelor's degree program in electrical engineering. In this comprehensive two-quarter course, students are expected to apply the concepts and theories of electrical engineering to a novel research project. A written report, giving details of the project and test results, and an oral presentation giving the details of the project, will be required to complete this course satisfactorily.

Topics
Projects will be carried out in four different sections corresponding to the main electrical engineering areas taught at UCR. Each section will have a "section professor" (i.e., faculty supervisor) as designated below. Possible project topics are obtained from the section professor.

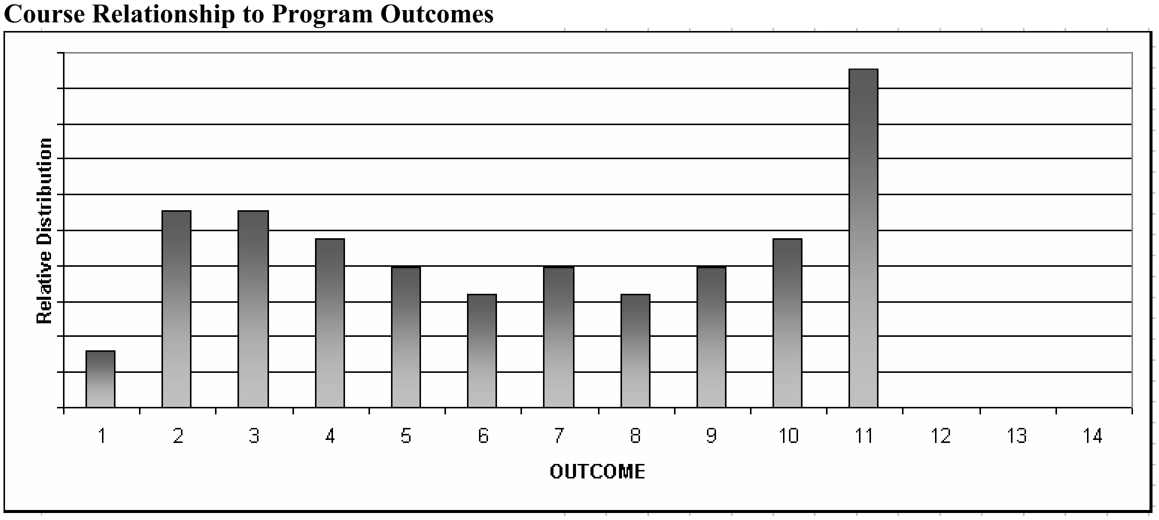
Electrical Engineering Area	Section Professor	Topics
Nano-Materials, Devices and Circuits (NMDC)	Mihri Ozkan	*Solarium Environment and Solar Cell Development* --- Students will build an environmental test chamber (i.e., Solarium) tha is capable of simulated sunlight at different intensities. The students will then fabricate organic solar cells and subsequently characterize these designs in the environmental test chamber.
Intelligent Systems (IS)	Matthew Barth	*Autonomous Vehicles* --- a variety of projects are offered focusing on various aspects of autonomous vehicle operation. Projects can span different platforms and applications, all the way from small micro-robots to larger electric vehicles. Projects will focus on sensors, vehicle control, navigation techniques, and integration. Example projects include micro-mouse, sumo robots, intelligent ground vehicle, and

		autonomous neighborhood electric vehicles.
Controls and Robotics (CR) (& Sensing)	Gerardo Beni and Amit Roy Chowdhury	*Controls and Systems* --- Students will work on various control, systems, and multi-media projects. Some projects will be offered with colleagues from the UCR music/performance department. *Image Processing* --- Other projects include face recognition, video based digital map design, and the synthesis of human activities using learned dynamical models.
Communications and Signal Processing (CSP)	Yingbo Hua, Ilya Lyubomirsky, and Sheldon Tan	*Ad Hoc Communication Networks* --- Projects include building and testing a network of three or more wireless nodes that can communicate with each other. Students will search and buy commercially available wireless transceivers and then design, develop, and implement communication protocols into the network. Students will demonstrate that their network can indeed perform communications among its nodes without assistance from any established base station.

Class/laboratory Schedule
Lecture, 3 hours; laboratory, 3 hours.

Course Contribution to Professional Component

Course Relationship to Program Outcomes



Prepared by: Instructor: Dr. Matthew Barth, Dr. Gerardo Beni, Dr. Amit Roy Chowdhury, Dr. Yingbo Hua, Dr. Ilya Lyubomirsky, Dr. Mihri Ozkan, Dr. Sheldon Tan

Graduate Assistant: Jack Kao

Date: