Computer Engineering at Fairfield University

The School of Engineering at Fairfield University offers a Computer Engineering Bachelor of Science degree. The program produces professionals who can work at the intersection of computer science, software engineering, electrical engineering, physics and mathematics.

Students focus on engineering applications and state of the art technologies. They gain an in-depth understanding of at least one area of Computer Engineering specialization.

The computer engineering program has three broad domains, signal processing, visualization and computer systems.

Software design principles are integrated throughout the program and are applied to custom engineering designs. Students obtain valuable engineering background in networking, computer graphics, image processing, video compression, transmission, visualization, display techniques and multimedia systems. Extensive experimental and computational facilities are available and close interactions are maintained with industry.

School of Engineering graduates are well rounded engineers with a background in liberal arts and the role of engineering technology in society. Graduates from this major should have a clear understanding of the design and applications of computers, including digital hardware and associated software, and be able to apply such knowledge throughout their professional careers.

Career Opportunities

Computer engineering is a new and rapidly evolving discipline. Graduates are employed by all sectors of industry, government, and academic institutions. Their work may involve the design of hardware and/or software for computer systems, the analysis and design of algorithms, or the use of computers for various applications. They also may work on research and development of new computer systems and applications.

Job demand for computer engineering graduates has been consistently strong. This demand should persist as computer technology advances at a rapid pace.

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1. DATA Structures in JAVA

Fairfield University

School of Engineering

Course Name & Number: DATA Structures in JAVA CS 232
Instructor: Prof. D. Lyon
Home Phone:
Business Phone:
E-mail: lyon@DocJava.com
FAX: (203)877-4187
Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 0 hours per semester

Course Description:

a study of data structures and algorithms. Topics include stacks, lists, queues, linked lists, trees, Binary Search Trees, B-trees, AVL-trees, reachability, Minimum Spanning Trees and Disjoint Sets, graph optimization.

PreReq: CS131

Learning Objectives:

After the student take this course, they will know how to write programs that divide the data structure into its specification (via *interface*) and subsequent implementation. The students will know how to think abstractly about data structures and be able to perform algorithm analysis. Students will have facility with linked lists, queues, trees, Priority queues and hash tables. Students will be able to write recursive programs, and sorting algorithms.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

1. The students will learn the principles of Data Structures.
   Expected learning outcomes:
   a. Big-O rules
   b. Data Structures (Stacks, Queues, Linked Lists, Trees, Hash Tables)
   c. Recursion, sorting (shell sort, merge sort, quick sort)
2. The student will become proficient with the usage of the Java language.
   Expected learning outcomes:
   a. Demonstrates the ability to utilize Java in practical data structures
   b. Uses appropriate object-oriented design patterns to solve problems.

After students take this course, they will know how to write programs that can use data structures. Finally, the students will make use of object-oriented design patterns and data structures in order to implement algorithms.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

When the course is done, Students will have deployed Java applications of their own design, on the web.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: DATA STRUCTURES & Problem Solving Using Java, by M. Weiss

Reference Material: Notes, as required.

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics :

1. Basic Java
2. Objects, Classes, and Packages
3. Inheritance
4. The AWT and Applets
5. Algorithm Analysis
6. Stacks and Queues (Part I)
7. Stacks and Queues (Part II) - Linked Lists
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- Linear-time construction
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- Insertion sort
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- Lower Bounds

13 Graph Algorithms

- Graph Representation

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- Minimum Spanning Trees
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- The Union/Find Data Structure

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

	Weighted	
Grading:		
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

2. Digital Design I

Fairfield University

School of Engineering

Course Name & Number: Digital Design I EE 245 + EE 245L
Instructor: Prof. D. Lyon
Home Phone:
Business Phone:
E-mail: lyon@DocJava.com
FAX: (203)877-4187
Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 0 hours per semester

Course Description:

Basic digital design principles. Boolean algebra. Combinational logic design with gates, MSI, LSI. Sequential logic design; register, counters, memory and PLD.
PreReq: EE 213

Learning Objectives:

After the student take this course, they will know how to perform elementary digital design.

This is a foundations course that enables students to be able to perform well in the follow-on course, Digital Design II.

Student knowledge of the basics culminated in being able to design and implement finite-state machines.

Outcomes:

1. The students will learn the principles of Digital Design.
   Expected learning outcomes:
   a. k-maps
   b. Boolean Algebra
   c. carry out a design using a simulator
2. The student will become proficient with a schematic capture simulator.
   Expected learning outcomes:
   a. Demonstrates the ability to implement a Finite State machine
   b. Implement an open-ended word problem with the simulator.

After students take this course, they will know how to write implement and simulate their digital designs.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Contemporary Logic Design, Katz

Reference Material: Notes, as required.

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Session #/Date	Topic	Text Chapter(s)	Homework Assignment

Topics :

1 Introduction
2 Boolean Algebra
3 Applications of Boolean Algebra
4 K-maps
5 Multi-level Gate Networks, Nand and NOR gates •
6 Multiple-output networks, Mux's,
7 Decoders, ROMs and PLA's
8 Flip-flops
9 Counters and Sequential Nets
10 Analysis of Clocked Sequential Nets •
11 Derivation of State Graphs and Tables •
12 Nets for addition and subtraction
13 State Machines and State Machine Charts

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted
Midterm	1/3
Comprehensive Final Examination	1/3
Homework	1/3 (tests, quizzes, projects..)

3. Digital Design II

Fairfield University

School of Engineering

Course Name & Number: Digital Design II EE 245 + EE 245L
Instructor: Prof. D. Lyon
Home Phone:
Business Phone:
E-mail: lyon@DocJava.com
FAX: (203)877-4187
Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 0 hours per semester

Course Description:

Computer architecture implemented using a hardware design language and PLDs. Students design, implement and program small RISC machines.

PreReq: EE 245

Learning Objectives:

After the student take this course, they will know how to implement and program a CPU using VHDL.

Students will understand CPU architectures, and how to program in VHDL.

Student knowledge of the basics culminated in being able to design and implement programmable finite-state machines.

Outcomes:

1. The students will learn the principles of Computer Architecture.
   Expected learning outcomes:
   a. broad understanding of computer architecture
   b. Basic parts of a CPU
   c. carry out a design using a PLD
2. The student will become proficient with VHDL.
   Expected learning outcomes:
   a. Demonstrates the ability to implement a RISC machine
   b. Program an open-ended word problem with the RISC machine.
   c. Perform Mealy sequential FSM design
   d. Design serial accumulator elements
   e. Design floating point elements
   f. Design a microcontroller CPU

After students take this course, they will know how to design and implement CPUS of their own design. They will also know a little about machine language programming..

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Digital Systems Design using VHDL by Roth.

Reference Material: Notes, as required.

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics :

1 Intro to VHDL
2 Counter Design/Memory
3 Finite State Machine design
4 Computer Organization
5 Busing strategies
6 Finite State Machines for Simple CPU's
7 Controller Implementation
8 Jump counters
9 Branch sequencers
10 Reduction of State tables State Assignment
11 Design of Microcontroller
12 Nets for multiplication and division
13. Verification
14. Model optimizations

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

4. Computer Networks

Fairfield University

School of Engineering

Course Name & Number: Computer Networks CE300
Instructor: Prof. D. Lyon
Home Phone:
Business Phone:
E-mail: lyon@DocJava.com
FAX: (203)877-4187
Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 0 hours per semester

Course Description:

Operating system elements, multi-threading, command-line interpreters and monitors. Students write their own operating system, implemented in Java, using a virtual machine. New system commands are added to the JAVAOS. Students deploy a custom-built, distributed, multi-platform, thin-client operating system.
PreReq: Data Structures in Java

Outcomes:

1. The students will learn the principles of Network Programming.
   Expected learning outcomes:
   a. Servlets
   b. RMI
   c. Object Serialization
2. The student will become proficient with the mathematical tools for modeling traffic.
   Expected learning outcomes:
   a. Demonstrates the ability to model m/m/1 and m/g/1 queues
   b. Simulate an Nth order Markov process.

After students take this course, they will know how to write implement and simulate models of traffic.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Java Network Programming, by Hughes et. Al.

Reference Material: Notes, as required.

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics by week:

1. OSI seven layer model, and TCP/IP suite
2. Services (FTP, Telnet, Gopher, Finger, SMTP, SNMP, HTTP, DNS)
3. Introduction to Cryptography, (public key encryption, hash functions, signatures)
4. Java Security model (manager, resource, threads, network resources)
5. Introduction to streams (output, input, file and filter streams)
6. Filter streams (buffered input and output streams, memory I/O streams., Piped streams)

7 Client-side networks (getting web pages with sockets, posting output streams)
8 Server-side networking (echo server, non blocking server, chat server)
9. Data gram networking (UDP alarms, a UDP echo server, message streams).
10. Queuing theory, (M/M/1, simple traffic, Poisson arrivals).
11. Simulating a Markov process, predicting traffic
12. Remote method invocation
13. Building a white board server
14 Building a white board client
15 Monitoring traffic in the system and correlating with simulation.

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

5. Operating Systems in Java

Fairfield University

School of Engineering

Course Name & Number: Operating Systems in Java CE 301
Instructor: Prof. D. Lyon
Home Phone:
Business Phone:
E-mail: lyon@DocJava.com
FAX: (203)877-4187
Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 0 hours per semester
Course Description:

PreReq: CS232 Data Structures in Java

Learning Objectives:

After the student take this course, they will know how to write Java programs that can perform network services. .

Students will understand the layers and protocols in the Internet and OSI models. Students will understand multi-threaded streaming, message routing, serialization and persistence.

Student knowledge of the basics culminated in being able to design and implement a client-server system.

Learning Objectives:

After the student take this course, they will know how to write Java programs that can perform operating system services. .

Students will understand the basic of operating systems. Students will design and implement their own operating system, with a web distribution requirement.

Student knowledge of the basics is culminated in the design of a thread management system, integrated into the JavaOS.

Outcomes:

1. The students will learn the principles of Operating System.
   Expected learning outcomes:
   a. Threads
   b. Command Line Interpreters
   c. Schedulers

2. The student will become proficient with the programming tools for implementing an operating system.
   Expected learning outcomes:
   a. Demonstrates the ability to add new system commands
   b. Build a thread manager.

After students take this course, they will know how to design and implement an operating system.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Inside the JAVAOS Operating System, by Saulpaugh et. Al.

Reference Material: Notes, as required.

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics by week:

1. Overview, JavaOS and the JDK, Computing models, major components
2. The database (The JavaOS System Database, JSD, Namespaces, trees and navigation)
3. The event system, consumer-producer ordering rules, threading, device events
4. Service loader, business cards, JavaOS configuration, service loader, client-server connections
5. Standard device support, networking video architecture, video designs, mouse and keyboard support
6. Device drivers, bus drivers, device handles, JDK serial port example
7. Memory, addressing, virtual addresses, page faults, memory regions
8. Interrupts, source tree, IST constructions, registering IS, interrupt dispatch
9. Microkernal, supervisor mode, architecture of interfaces and managers, interrupt processing
10. Booting Java OS boot interface
11. Using introspection to list available methods
12. Design of a command-line interface
13. Adding a process monitor to the JAVA OS
14. System commands for managing threads in JAVA OS

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

6. Eng. Applications of Numerical Methods

Eng. Applications of Numerical Methods

Fairfield University

School of Engineering

Course Name & Number: Eng. Applications of Numerical Methods CE 302

Instructor: Prof. D. Lyon
Home Phone:
Business Phone:
E-mail: lyon@DocJava.com
FAX: (203)877-4187

Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 0 hours per semester

Course Description:

Root-finding, interpolation, linear algebraic systems, numerical integration, and numerical solution of ordinary and partial differential equations. Substantial programming projects required. The theoretical basis is provided for the students to proceed in computer graphics and voice and signal processing.

PreReq: CS232 Data Structures in Java, MA 227 (calc III)

Learning Objectives:

After the student take this course, they will know how to write programs that find Roots of Equations using a variety of methods, including Bisection, Newton Raphson, Secant Method and Regular Falsi.

They will also have a basic understanding of the solving of simultaneous equations using Gaussian Elimination, Gauss-Jordan Elimination, LU Decomposition, Jacobi Iteration and Gauss-Siedel Iteration. Students make use of data structures,

and there math background to set up and display solutions Using linear, Cubic & quadratic splines. Students will learn Numerical differentiation and Numerical Integration. Students are introduced to transform methods.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

1. The students will learn the principles of Numerical Methods.
   Expected learning outcomes:
   a. Numeric Integration (Trapezoidal, Simpson's, Romberg, Gauss-Legendre)

b. Differential Equations (Euler's Method, Runge-Kutta, Predictor-Corrector)
c. Curve Fitting (least-square lines, splines, Trigonometric Polynomial). Transform Methods (convolution, DFT, DHT, DCT)

2. The student will become proficient with the usage of the Java language. Expected learning outcomes:
   a. Demonstrates the ability to utilize Java in practical numerical method problems.
   b. Uses appropriate object-oriented design patterns to solve problems.

After students take this course, they will know how to write programs that can solve problems that have no closed-form solutions. Finally, the students will make use of data structures, linear algebra, and object-oriented design patterns in order to solve numeric methods.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

When the course is done, Students will have deployed Java applications of their own design, on the web.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Numerical Methods in Java, a manuscript by D. Lyon

Reference Material: Numerical Recipes in C, Press et Al.

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics :

1.: Root-finding;
Bisection, Newton Raphson, Secant Method and Regular Falsi.

2. Simultaneous equations using:
Gaussian Elimination, Gauss-Jordan Elimination, LU Decomposition, Jacobi Iteration and Gauss-Siedel Iteration.

3. Approximation
linear, Cubic & quadratic splines. Least-square lines, splines, Trigonometric Polynomial.

4. Numerical differentiation:
Euler's Method, Runge-Kutta, Predictor-Corrector

5. Numerical Integration:
Trapezoidal, Simpson's, Romberg, Gauss-Legendre

6. Transform Methods

c. Transform Methods (convolution, DFT, DHT, DCT)

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

7. Computer Graphics

Fairfield University

School of Engineering

Course Name & Number: Computer Graphics CE 303
Instructor:
Home Phone:
Business Phone: SAMPLE
E-mail:
FAX:
Instructor Assistance: (additional support prior to and/or after class)
Lecture Hours: 3 hours per week starting at 6:30PM
Lab Hours: 3 hours per semester

Course Description:

A unified, introductory treatment to two-dimensional and three-dimensional computer graphics concepts. Topics include Human-computer interfaces using the AWT, applied geometry; homogeneous coordinate transforms; Bezier curves, Bernstien Basis Polynomials, Hermite Polynomials, B-Spline curve fitting. Rendering topics: z-buffer algorithm, painters algorithm, raytracing, and texture mapping.

Prerequisite – CE Eng. Applications of Num. Methods, MA 211

Course Objectives and Learning Outcomes:

This course designed to support the visualization and computer systems domain in the CE BS degree.

1. The students will learn the principles of Computer Graphics.
   Expected learning outcomes:
   a. Applies transform concepts in programming situations
   b. Recognizes interrelationships among geometric modeling and computer graphics
2. The student will become proficient with the usage of the Java language.
   Expected learning outcomes:
   a. Demonstrates the ability to utilize Java in practical visualization problems.
   b. Uses appropriate object-oriented design patters to solve problems.

After the student take this course, they will know how to write programs that display and manipulate 3D objects. They will also have a basic understanding of geometric modeling and computational geometry. Finally, the students will make use of data structures, linear algebra, design patterns and basic software engineering.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

When the course is done, Students will have deployed Java applications of their own design, on the web.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Computer Graphics for Java Programmers by Ammeraal

Reference Material: The Java 3D API Specification

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Obtain data during laboratory hands on session.

Topics (listed by week):

1. Historical perspective and some fundamental issues in hardware, software and applications.
2. The use and implementation of Java 2D, a simple 2D graphics package.
3. Graphics hardware.
4. Transforms in the plane and 3-space, representation by matrices, homogeneous coordinates, 3D views.
5. Java 3D, a 3D floating-point hierarchical graphics package.
6. Human color-vision system, various color-description systems.
7. Shaded graphics, aliasing
8. Visible-surface determination.
9. Illumination and shading, texture, shadows, transparency, reflections,
10. Image manipulations, scaling, shearing, rotation pixmaps. Image storage techniques.
11. Computer Animation.
12. physically based illumination models, .
13. ray tracing
14. radiosity

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

8. Voice and Signal Processing

Fairfield University

School of Engineering

Course Name & Number:	Voice and Signal Processing	CE 304
Instructor:	Prof. D. Lyon	
Home Phone:		
Business Phone:		
E-mail:	lyon@docjava.com	
FAX:	(203)877-4187	
Instructor Assistance:	(additional support prior to and/or after class)	
Lecture Hours:	3 hours per week starting at 6:30PM	
Lab Hours:	0 hours per semester	

Course Description:

Overview of Digital Audio and its application Current state of streaming Audio on the Internet Digital Audio Processing Fundamentals. This course applies the theories laid down in CE Eng. Applications of Num. Methods to the areas of audio processing.

Students will apply the theories of Sampling, Spectra, Fast Fourier Transform Class, convolution and frequency space processing, compression and one-dimensional streaming.

Students will apply the theories by creating programs that read processing and write audio streams. They are exposed to the elements of multi-media network delivery of data. They learn about a wide class of FFT algorithms and elementary sound synthesis.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Students will learn enough signal processing to take Image Processing, the follow-on course.

Prerequisite – CE Numeric Methods, MA 211 (matrix theory)

Learning Objectives for Voice and Signal Processing

This course designed to support the signal processing and computer systems domain in the CE BS degree.

When the course is done, Students will have deployed

Java applications of their

own design, on the web. These applications will

demonstrate the usage of Java for real-time

voice and sound processing.

1. The students will learn the principles of Digital Signal Processing.
   Expected learning outcomes:
   a. Applies transform concepts in programming situations
   b. Recognizes interrelationships among signals and spectra
   2. The student will become proficient with the usage of the Java language.
   Expected learning outcomes:
   a. Demonstrates the ability to utilize Java in practical signal processing problems.
   b. Uses appropriate object-oriented design patters to solve problems.
   After the student take this course, they will know how to write programs that display and manipulate 1D waveforms. They will also have a basic understanding of constructive and destructive synthesis. Finally, the students will make use of data structures, linear algebra, design patterns and basic software engineering.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

When the course is done, Students will have deployed Java applications of their own design, on the web.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Java Digital Signal Processing by Douglas Lyon

Reference Material: Digital Audio with Java, by Lindley

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics :
1. Overview of Digital Audio and its application
Current state of streaming Audio on the Internet
Problems and solutions
2. Digital Audio Processing Fundamentals
Sampling
Spectra
3. The AudioFrame Class
internal data structures

- the AudioStream
- the AudioDataStream
- doubleData
- ulawData
- the AudioPlayer

building the menu
- intercepting menu event
- intercepting keyboard events

4. Audio Files
   - Audio file formats
   - u-law companding in the Sun AU files
     - decoding u-law
     - encoding u-law
   - reading
   - writing
   - playing
   - graphing
5. Wave Table Generation
   - Sine
   - Triangle
   - Square
   - Sawtooth
6. Audio Processing
   - Delay, echo vs. reverb
   - The Discrete Fourier Transform
   - The Inverse DFT
   - The Fast Fourier Transform Class
   - The Inverse FFT method
   - Fast Convolution using the FFT
   - Power Spectral Estimation
   - Frequency shifting using the FFT
   - Filtering using FFT
7. Sound Synthesis
   - Additive Synthesis
   - Subtractive Synthesis
8. Generalized Modulations
   - AM
   - FM
9. Object Oriented Design Patterns and signal Processing
   - Producer consumer

References

10. Wavelets in Computer Graphics11. Transform compression techniques
12. Multi-media application
13. Telephony
14. Streaming Audio

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

9. Image Processing

Fairfield University

School of Engineering

Course Name & Number:	Image Processing CE 305
Instructor:	Prof. D. Lyon
Home Phone:	
Business Phone:	
E-mail:	lyon@DocJava.com
FAX:	(203)877-4187
Instructor Assistance:	(additional support prior to and/or after class)
Lecture Hours:	3 hours per week starting at 6:30PM
Lab Hours:	0 hours per semester

Course Description:

A first course in Image Processing; Image algebra,arithmetic operations,boolean operations, matrix operations

Achromatic and Colored Light

Selecting Intensities, Gamma Correction

Chromatic Color, psychophysics, Color models

Color Space Conversion, low-level pattern recognition.

Students will learn the theory of 2-D Fast Fourier Transform Class, 2D convolution and frequency space processing, compression and 2D streaming.

Students will apply the theory by creating programs that read processing and write image streams. They are exposed to the elements of multi-resolution multi-media network streaming. They learn about a wide class of transforms, including Wavelets, DCT, the PFA FFT and others.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Students will learn enough signal processing to write their image processing applications.

Prerequisite – PreReq: CE 304 Voice and Signal Processing

Learning Objectives for Image Processing

This course designed to support the signal processing and computer systems domain in the CE BS degree.

When the course is done, Students will have deployed Java applications of their own design, on the web. These applications will demonstrate the usage of Java for image processing.

1. The students will learn the principles of Image Processing.
   Expected learning outcomes:
   a. Applies transform concepts in programming situations
   b. Recognizes interrelationships among signals and spectra
2. The student will become proficient with the usage of the Java language.
   Expected learning outcomes:
   a. Demonstrates the ability to utilize Java in practical image processing problems.
   b. Uses appropriate object-oriented design patters to solve problems.

After the student take this course, they will know how to write programs that display and manipulate 2D images. They will also have a basic understanding of image filtering. Finally, the students will make use of data structures, linear algebra, design patterns, voice and 1D signal processing.

This course requires substantial programming effort and emphasis is place on good software engineering practices.

Outcomes:

When the course is done, Students will have deployed Java applications of their own design, on the web.

Performance Indicators:

Aside from the basics assessment procedures based on homeworks and tests, Students must obtain 75% or better on all tests. Additionally, students must perform at least 75% on the homeworks.

Textbook: Image Processing, in Java by Douglas Lyon

Reference Material: Java Digital Signal Processing, By Dougas Lyon

Course Requirements:

All homework is to be submitted on time.

The course includes three reporting periods (exam, quiz, project, etc.) and a comprehensive final.

Topics :

Topics: (coverage will be altered to encompass the latest APIs)

Week 1: Using the AWT - The new Event model

- The Graphics Class
  - Test Patterns
    - Color Bars
    - resolution chart
    - multi-burst test chart
    - Snell and Wilcox test chart
- Interaction
  - The mouse
  - The keyboard
  - The Evt class
- building the menu
  - intercepting menu event
  - intercepting keyboard events

Week 2: The Model-View Approach
observables and the dialogs boxes
Int Dialog
Float Dialog
File dialogs
The ImageFrame Class
oldPixels
newPixels
menu construction
Week 3: Streams
File input stream
stream tokenizer
closing a file
token flags
writing files
summary for writing files
Save File Example/ set-up main menu bar
Process menu pick - save
Week 4: Digital Image Processing Fundamentals
Overview of Image Processing and its application
Image Storage and Display
image models
cameras video and scanners
Current state of streaming video on the Internet
Problems and solutions
Sampling
Spectra and Spectra
Preview of Image processing
Week 5: The PixelPlane Class
range checking
PixelGrabbers
internal data structures
the ImageStream
the ImageDataStream
Image doubleData
Reading and Writing Images
Reading GIF and JPEG
Writing GIF
Reading PPM
Writing PPM
Week 6: Edge Detection
Roberts, Prewitt, Frei-Chen,
Kirsch, Sobel,
boxcar, pyramid, argyle, Macleod,
derivative of Gaussian, Robinson,
Canny
Laplacian generation, Laplacian of Gaussian
Hat
Week 7: Boundary Processing
XY to Vector Conversion
vector ordering using Dijkstras' algorithm
Edge following and Martellis' algorithm
Divide-and-conquer boundary detection
Range finding via diffraction

Range map to boundary representation
Week 8: Image Enhancement Techniques
Blur
mean, median, unsharp
smoothing binary images by association
local area contrast enhancement
histogram equalization
lowpass filtering
highpass filtering
averaging multiple images
Week 9: Achromatic and Colored Light
Selecting Intensities-Gamma Correction in Java
Chromatic Color
psychophysics
Color models (CIE, RGB, YUV, CMY, HSV, YIQ)
Color coordinate systems
RGB to L*u*v*, L*u*v* to RGB
RGB to L*a*b*, L*a*b* to RGB
RGB to XYZ, XYZ to RGB
RGB to YIQ, YIQ to RGB
RGB to YUV, YUV to RGB
RGB to HSV, HSV to RGB
RGB to HLS, HLS to RGB
Week 10: Thresholding techniques
Global thresholding
multilevel thresholding
variable thresholding
thresholding using image statistics
using mean and standard deviation
using maximization of between-class variance
Week 11: Morphological filtering
set theory
arithmetic operations
boolean operations
erosion and dilation
medial axis transform
skeletonization
Week 12: Warping
scaling
rotation
shear
cutting and pasting
conformal image mapping
warping
Week 13: The Cosine Transform
The Discrete Cosine Transform
The Inverse Discrete Cosine Transform
The Fast Cosine Transform Class
Reading and Writing JPEG Images
Week 14: The InLine MPEG CODEC
Compressed MPEG movies images
decoding MPEG
encoding MPEG
reading MPEG files

writing MPEG files
displaying MPEG files
measuring loss
Implementing in-line Java Decoders

Week 15: The Wavelet Transform
The Discrete Wavelet Transform
The Inverse Discrete Wavelet Transform
The Fast Wavelet Transform Class
Writing a wavelet encoded file
Decoding the wavelet encoded file
Incorporating the decoder with the data
Distribution of wavelet images on the Net.

Attendance Policy: Students are responsible to acquire notes and homework assignment from classmates in case of absence.

Grading:

	Weighted	
Midterm	1/3	
Final Examination	1/3	
Homework	1/3	includes tests, quizzes, projects, etc.

B.S. IN COMPUTER ENGINEERING

School of Engineering

Fairfield University

Required Credits = 1

Required residency = 6

Total Transfer = _

Evaluation Record

Student : _____ Ac

S.S. #: _____ D

Mathematics		Electrical Engineering		Computer Engineering	
MA 125 CALCULUS I	3	EE 213 ANAL CIRC. ANAL I	3	CPE 320 Computer Networks	
MA 126 CALCULUS II	3	EE 213L ANAL CIRC. ANAL I LAB	1	CPE 310 Voice & Signal Processing	
MA 227 CALCULUS III	3			CPE 311 Image Processing	
MA 228 CALCULUS IV	3	**Computer Science**		CPE 325 COMP. GRAPHICS	
MA 321 ORD DIFF EQUAT	3	CS 131 Comp. Prog. I	3	CPE 245 DIGITAL DESIGN I	
MA 211 Applied Matrix Theory	3	CS 132 Comp. Prog. II		CPE 245L DIGITAL DESIGN Lab	
MA 217 Applied Statistics	3	CS 232 Data Structures in Java	3	CPE 246 DIGITAL DESIGN II	
		Restricted Elective 1	3	**Senior Project**	
		Restricted Elective 2	3	CPE 390 SENIOR PROJECT I	3
Physics		Restricted Elective 3	3	CPE 391 SENIOR PROJECT II	3
PS 15 GEN.PHYSICS I	3				
PS 15L GEN.PHYS.LAB	1	**Gen. Eng.**			
PS 16 GEN.PHYSICS II	3	EG. 31 Fund. of Eng.	3		
PS 16L GEN PHYS LAB	1	EG. 31 Fund. of Eng.	3		
PS 203 LAB OPT. & LASERS	1				
PS 222 OPTICS & WAVE	3	**Mechanical Eng.**			
PS 206 Lab in Adv. Opt. Comm	1	ME 201 STATICS	3		
Total	34	Total	28	Total	

TRANSCRIPT DATA:

ADVISOR'S COMMENTS

SIGNATURE _____

Full Size versions of the Above Sheet are available

A list of some suggested restricted elective sequences follows:

Restricted Electives come from a sequence with directed specialization, from EE, ME, CS, CPE or MA departments. At least on prereq is required. For example:

Robotics	Communications	Computer Hardware	Comp. Science Plan A
ME 203 Kinematics/Dynamics	EE 301 Signals and Systems	EE 345 Digital Computer Systems	CS 231 Disc. Math
MF361 Automation and Robotics I	EE 350 Communication Systems	EE 346 Microprocessor Hardware Control	CS 342 Theory of Computation
MF 362 Automation and Robotics II	EE 352 Digital Communication Systesm	EE 358 VLSI Systems Design	CS 353 Principles of Comp. De

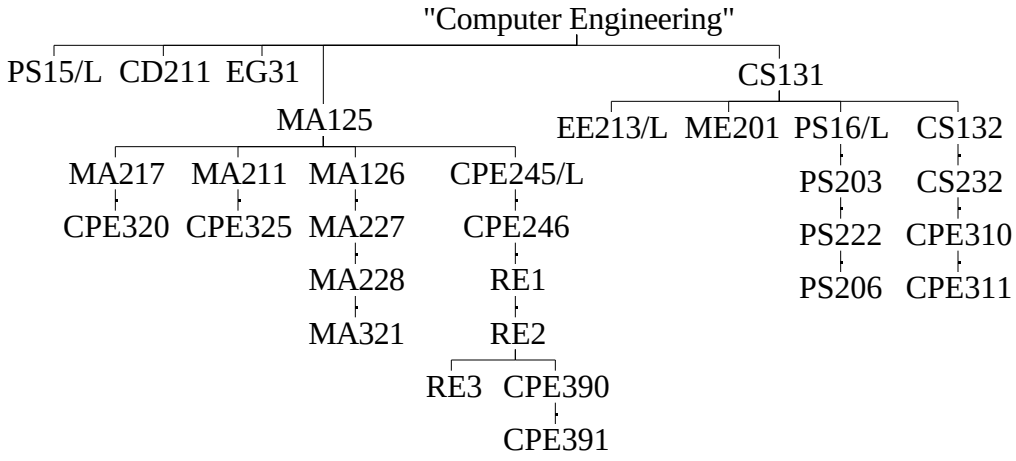
Math	Electronic Devices	Comp. Science Plan B
MA 371 Real Analysis	EE 207 Electronic Materials	CS 231 Disc. Math
MA 383 Modern Geometry	EE 231, 231L, Electronics I	CS332 OS 2
MA 385 Point Set Topology	EE 331, 331 L, Electronics II	CS 342 Theory of Computation

A sample plan of study follows.

Term 1		yr	SFU	grade	**Term 2**		yr	SFU	grade
MA 125 CALCULUS I	3				MA 126 CALCULUS II	3			
EN 11 COMPOSITION & PROSE	3				EN 12 INTRO to LITERATURE	3			
EG. 31 Fund. of Eng.	3				EG. 32 Fund. of Eng.	3			
PS 15 GEN.PHYSICS I	3				PS 16 GEN.PHYSICS II	3			
PS 15L GEN.PHYS.LAB	1				PS 16L GEN PHYS LAB	1			
CS 131 COMP. PROGRAMMING	3				CS 132 COMP. PROGRAMMING II	3			
total	16				total	16			
Term 3					**Term 4**				
MA 227 CALCULUS III	3				MA 228 CALCULUS IV	3			
PS 203 LAB OPT. & LASERS	1				AH 10 INTRO TO ART HISTORY I	3			
PS 222 OPTICS & WAVE	3				PH 10 INTRO to PHILOSOPHY	3			
CPE 245 DIGITAL DESIGN I	3				CPE 246 DIGITAL DESIGN II	3			
CPE 245L DIGITAL DESIGN Labo	1				HI 30 EUROPE & WORLD IN TRANS	3			
RS 10 INTRO RELIGIOUS STUDY	3				CS 232 Data Structures	3			
ME 201 STATICS	3								
total	17				total	18			
Term 5					**Term 6**				
MA 321 ORD DIFF EQUAT	3				MA 211 Applied Matrix Theory	3			
Restricted Elective 1	3				Ma 217 Applied Statistics	3			
CPE 310 Voice and Signal Processin	3				CPE 311 Image Processing	3			
EE 213 Analog Electronics & Circui	3				PH/RS ELECTIVE (ETHICS)	3			
EE 213L Analog Electronics & Circu	1								
ENGLISH ELECTIVE	3				CD 211 Engr. Graphics CAD I	3			
total	16				total	15			
Term 7					**Term 8**				
CPE 320 Computer Networks	3				CPE 325 Computer Graphics	3			
PH ELECTIVE	3				History Elective	3			
Restricted Elective 2	3				Restricted Elective 3	3			
PS 206 Lab in Adv. Opt. Comm	1				EC 11 Microeconomics	3			
CPE 390 SENIOR PROJECT I	3				CPE 391 SENIOR PROJECT II	3			
RS ELECTIVE	3				Social Science Elective	3			
total	16				total	18			

The above figure is available in full size and is a sample only.

A sketch of the courses by pre-requisite follows:



Should the pre-req chart differ from the catalog, the student is advised to follow the catalog or consult the advisor. For simplicy, crossing lines have been eliminated. This has caused some errors in the chart. For example, CS232 is a pre-req for CPE325, but not shown on the chart.