

# Courses of Instruction

# Computer Engineering

## COMPUTER ENGINEERING 408

### **Operating Systems.**

Structure and design of computer operating systems. Synchronization of processes; deadlock avoidance; CPU management; file management; memory management; and device management. Prerequisite: Computer Science 102, Computer Engineering 312.

*3 semester hours*

## COMPUTER ENGINEERING / ELECTRICAL ENGINEERING 446

### **MEMS (Micro-Electro-Mechanical Systems).**

Basic micro fabrication techniques, MEMS materials and their properties, MEMS device design and simulation, MEMS packaging and assembly, signal testing and MEMS reliability analysis. MEMS industrial applications in various areas will also be discussed. Students used ANSYS FEM software to design and simulate their behavior.

## COMPUTER ENGINEERING 447

### **Logic Synthesis Using FPGAs.**

Logic design using textual design entry, VHDL. Behavioral, structural and data flow descriptions. Technology-dependent vs. technology-independent design. CPLD, SRAM and antifuse technologies. Rapid prototyping and retargeting designs. A major design project. Prerequisite: Computer Engineering 315.

*3 lecture hours, 3 semester hours*

## COMPUTER ENGINEERING 448

### **Introduction to VLSI Design.**

Design and implementation of a very large scale integrated circuits. CMOS and BiCMOS technologies, basic topological structure of ICs, clocking characteristics, resistance, capacitance and power estimation, System-level design and implementation issues. Custom layout and verification using CAD tools. Synthesis of designs from VHDL descriptions. Term project will include the design and testing of an integrated circuit. Prerequisites: Computer Engineering 315 and Electrical Engineering 348.

*3 lecture hours, 3 semester hours*

## COMPUTER ENGINEERING / ELECTRICAL ENGINEERING 458

### **Analog VLSI.**

Modeling, design and analysis of analog VLSI circuits. CMOS processing and layout, current mirrors, Opamp, comparators, S/H voltage references, switched-capacitor circuits, data converters, filters and PLLs. Students design analog VLSI layouts, extract the netlists and simulate the circuit behavior. Transistors sizing will also be discussed. EDA tools PSPICE, Mentors Graphics are used.

## COMPUTER ENGINEERING 460

### **Introduction to Robotics.**

Basic Robotics, including: position and velocity sensing, actuators, control theory, robot coordinate systems, robot kinematics, differential motions, path control, dynamics, and force control. Robot sensing, simulation of manipulators, automation, and robot programming languages are also investigated. Prerequisites: Computer Science 102, Electrical Engineering 360, Math 214 or 314 or permission of instructor.

*3 lecture hours, 3 semester hours*

## COMPUTER ENGINEERING 471

### **Data and Computer Communications.**

Introduction to data communication. Frequency response, bandwidth, filtering and noise. Fourier series and Fourier transform. Information theory concepts: Nyquist's theorem, Shannon's and Sampling theorems. Analog and digital modulation techniques. Pulse Code Modulation (PCM). Communication systems circuits and devices. Data encoding. Physical layer protocols. Data link control (point to point communication, design issues, link management, error control, flow control). Multiplexing and switching. Prerequisite: Computer Science 102, Computer Engineering 210.

*3 lecture hours, 3 semester hours*

## COMPUTER ENGINEERING 472

### **Computer Networks.**

Introduction to computer networks. Circuits, message, packet and cell switching. WAN and LAN design issues. LAN standards. Network layer design issues. Routing and congestion control. Inter-networking. ISDN, B-ISDN, and ATM. Transport layer design issues and protocols. Application layer design issues and protocols. Examples of

protocol suites and networks. Prerequisite: Computer Engineering 471 or permission of instructor. *3 lecture hours, 3 semester hours*

## COMPUTER ENGINEERING 473

### **Local Area Networks.**

Introduction to Local Area Networks (LANs). Classes of LANs. LAN design issues. LAN topologies. LAN transmission media. LAN protocols: Medium Access Control (MAC) and Logic Link Control (LLC). LAN standards. Network software. Network operating systems. LAN performance modeling and analysis. Internetworking: Bridges, Routers and Gateways. Reliability, availability, survivability and security. Prerequisite: Computer Engineering 471.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 481

### **Mobile Communications.**

This course covers the basic technologies in the field of wireless and mobile communications. The following topics are covered in the course: wireless transmission, media access control, satellite systems, broadcast systems, wireless LANS, wireless ATM, network layer protocols, transport protocols and support for mobility. Prerequisites: Computer Engineering 471 or Computer Engineering 472 or permission of instructor.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 482X

### **Network Administration.**

Internetworking basis. Bridging and Switching Fundamentals. Routing basic. Network management fundamentals. Network architecture. Security. Troubleshooting. Pre-requisites: Computer Engineering 471 or Computer Engineering 473 and permission of instructor.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 489

### **Software Engineering.**

Structural development methodology for large software systems. Planning requirements, design, test, and validation. Advanced topics in software development. Prerequisite: Computer Science 102 and senior status.

# Courses of Instruction

# Computer Engineering

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 500

### **Graduate Co-op/Internship in Computer Engineering.**

By arrangement.  
1-3 semester hours

## COMPUTER ENGINEERING 510

### **Introduction to Computer Architecture.**

Instruction set; data path and controller design for computers. Design and analysis of a RISC processor including integer and floating point pipeline design. Cache and virtual memory design, interrupts and DMA. Prerequisite: Computer Engineering 312 or equivalent background.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 540

### **Image Processing.**

This is a project-oriented course. Students will learn and implement FFT with applications, image enhancement, image restoration, image compression, and image tomography. Projects will be conducted on workstations. Prerequisite: Electrical Engineering 443.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING / ELECTRICAL ENGINEERING 548

### **Low Power VLSI Circuit Design**

With the rapid development of mobile computing, low power VLSI design has become a very important issue in the VLSI industry. A variety of low-power design methods are employed to reduce power dissipation of VLSI chips. This course is designed to cover low-power design methodologies at various design levels (from system level to transistor level). The basic low-power design strategies will be introduced in the class. Students will use the learned knowledge to design low-power VLSI circuits. Upon completion of this course, students will be able to analyze the power consumption of VLSI circuits, and design low-power VLSI circuits using various strategies at different design levels. The major target is to design VLSI chips used for battery-powered systems and high-performance circuits not exceeding power limits.

*3 semester hours*

## COMPUTER ENGINEERING 550

### **Advanced VLSI Design.**

Implementation of custom VLSI designs, digital and analog simulation, fault tolerant design, design for testability. A major project will include the implementation of a digital integrated circuit. Prerequisites: Computer Engineering 448D.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 457

### **Electronic Design Using Programmable Analog Arrays.**

Use of design methodologies to implement analog circuits using programmable analog arrays. Introduction to design tools for circuit implementation. Laboratory experience includes design of analog filters, photoplethysmography, a non-invasive method of measuring blood pulsations, temperature measurements with PWM fan control, motor control using PID controllers, among others. Design tools include MatLab and design tools from Anadigm, Inc. (schematic capture and simulation)

## COMPUTER ENGINEERING 560

### **Performance Evaluation and Analysis.**

This course covers the basic theory and practice of computer systems performance evaluation. The course focuses on three major aspects of performance analysis, measurement, simulation and analytical modeling using queuing theory. The topics will include measurement techniques, monitor tools, simulation models, stochastic processes, queuing theory and analytical modeling techniques. Prerequisites: Background in computer architecture and Probability and consent of the instructor.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 561

### **Network Security.**

Conventional encryption and message confidentiality, public-key cryptography and message authentication. Authentication applications, electronic mail security, IP security, web security, firewalls, security in mobile network and other security systems. Prerequisites: Computer Engineering 471 or 473.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 570

### **Advanced Robotics.**

Advanced robotics and automation topics and techniques, including: active robotic sensing, intelligent and integrated manufacturing systems, robotic inspection, observation under uncertainty, multisensor feedback control of manipulators and mobile robots, advanced simulation and monitoring of robotic systems, high level modeling and control, and other topics. Prerequisites: Computer Science 460, Computer Engineering 460 or permission of instructor.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 584

### **Machine Perception.**

An introduction to sensing and machine vision. Vision algorithms that are usable in practical applications, sensing mechanisms and various types of sensed data representation, sense data processing and interpretation for different applications. Prerequisites: Computer Science 400, Computer Engineering 312 and Electrical Engineering 443.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 585

### **Computer Vision.**

A project-oriented course designed to familiarize the student with the computer image display, processing, and various limitations. The processing includes edge detection, Hough transform, thinning algorithms, moment invariant methods, relaxation algorithms, among others. Prerequisite: Computer Science 400, Computer Engineering 312, Electrical Engineering 443.

*3 lecture hours; 3 semester hours*

## COMPUTER ENGINEERING 588D

### **Interactive Computer Graphics.**

Introduction to interactive computer graphics in computer-aided design. CRT display techniques; programming and graphic display principles; 2-D and 3-D display methods; command and programming languages for graphics. Term project using interactive display device is required. Prerequisites: Computer Engineering 312 and Computer Science 400.

*3 lecture hours; 3 semester hours*

# Courses of Instruction

# Computer Engineering

COMPUTER ENGINEERING 597 A

**Master's Project.**

Lecture hours and topics to be arranged with  
Department Chair.

*1 semester hour*

COMPUTER ENGINEERING 597 B

**Master's Project.**

Lecture hours and topics to be arranged with  
Department Chair.

*2 semester hours*

COMPUTER ENGINEERING 597 C

**Master's Project (completion).**

Lecture hours and topics to be arranged with  
Department Chair.

*1 semester hour*

COMPUTER ENGINEERING 598

**Thesis in Computer Engineering.**

Lecture hours, semester hours and topics to  
be arranged with Department Chair.

*3-6 semester hours*

COMPUTER ENGINEERING 599

**Independent Study in Computer  
Engineering.**

Independent study of advanced topics in  
Computer Engineering and submission of  
project report as required. Problem  
assignment to be arranged with and  
approved by the Department Chair.

*3 semester hours*