Computer Engineering: MS Program Overview

Course Offerings

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Chair, Computer Engineering Program
Overview of 4000-/6000-Level Comp Eng Courses

• Selective survey of some key computer engineering courses
• Focus: COMS (i.e. CS), CSEE, EECS courses
  • EE comp eng courses: covered in EE presentations
• ... incomplete list: MS degree allows other courses too
Digital/VLSI Design

CSEE 4823 Advanced Logic Design  [Fall 09/Fall 10]

Instructor:  Prof. Steven Nowick

Description:
• 2nd-level course in modern digital design
• **Topics include:**
  • VHDL (industrial hardware description language)
  • controller design (Mealy/Moore)
  • designing/optimizing large complex subsystems =RTL design (floating point units, etc.)
  • advanced high-speed arithmetic circuits (Kogge-Stone adders, array multipliers)
  • asynchronous design
  • testability, soft errors
  • fault-tolerance, error correction/detection, Hamming codes
  • modeling + simulation via CAD tools
  • small design projects
Digital/VLSI Design (cont.)

EECS 4340 Computer Hardware Design [Fall 09/Fall 10]

Instructor: Prof. Simha Sethumadhavan

Description:
• Practical hardware design through implementation, simulation and prototyping of a PDP-8 processor

• Topics include:
  • assembly language, I/O, interrupts
  • datapath + control design
  • buses, memory architecture
  • programmable logic: hardware prototyping with FPGA’s
  • fundamentals of Verilog
  • testing and validation of hardware
  • industrial CAD tools
  • major lab project
Digital/VLSI Design (cont.)

ELEN 4321 Digital VLSI Circuits [Fall 09/Fall 10]

Instructor:  Prof. Ken Shepard

Description:
- Design and analysis of high speed VLSI logic and memory circuits.

[see EE course presentation]
CSEE 4824 Computer Architecture [Fall 09/Fall 10]

Instructor:  Prof. Luca Carloni

Description:

• Advanced topics in modern computer architecture, illustrated by recent case studies.
• **Topics include:**
  • quantitative analysis
  • pipelining, out-of-order execution, speculation
  • superscalar, VLIW and vector processors
  • embedded processors
  • memory hierarchy design
  • multi-processors and thread-level parallelism
  • synchronization and cache coherence protocols
  • interconnection networks
CSEE 6824 Parallel Computer Architecture [Spring 10]

Instructor: Prof. Simha Sethumadhavan

Description:

- Fundamentals of parallel computer systems
- **Topics include:**
  - recent parallel architectures (industrial/research)
  - shared memory and distributed memory systems
  - synchronization and coherence models
  - recent case studies
COMS 6998-1 Princ./Practice of Parallel Programming 
(NEW) [Fall 09/Fall 10]

Instructor: Prof. Kim/Dr. Saraswat

Description:

- Programming parallel processors, concurrency foundations.
- **Topics include:**
  - basics of parallel programming
  - principles of concurrency: data parallelism, deadlock, determinacy
  - pgmg. assignments: incl. game playing, high-performance cptg., machine learning
  - modern parallel programming languages
Embedded Systems

CSEE 4840 Embedded Systems [Spring 10]

Instructor: Prof. Stephen Edwards

Description:

• Embedded system design and implementation combining hardware and software.

• **Topics include:**
  • hardware/software interfacing
  • bus protocols and device drivers
  • custom peripherals
  • microprocessor-based system design
  • team project target: a substantial embedded system
    • hardware/software design employing FPGA’s
    • e.g. digital tone control, speech synthesizer, internet radio, interfacing and peripherals
Embedded Systems (+ SoC/NoC)

CSEE 6847 Distributed Embedded Systems [not offered S10]

Instructor: Prof. Luca Carloni

Description:

• Inter-disciplinary graduate course on design of distributed embedded systems.

• **Topics include:**
  • system robustness: variable communication delays + component behaviors
  • communication protocols
  • on-chip communication micro-networks
  • fault-tolerant architectures
  • robust deployment of embedded software
  • recent research challenges in: design complexity, scalability, security
Computer-Aided Design (CAD)

CSEE 6861 Computer-Aided Design of Systems [Spring 10]

Instructor: Prof. Steven Nowick

Description:
• Introduction to modern CAD tools and algorithms for designing digital systems.
• **Topics include:**
  • high-level synthesis and optimization of custom function units
  • synthesis and optimization of finite state machines
  • two-level/multi-level logic minimization
  • technology mapping to cell libraries
  • static timing analysis, testability
  • introduction to asynchronous design
  • small project: design of a CAD package
Special Offerings:

CS 6998-3 Formal Verification of Hardware/Software Systems [Fall 09/Fall 10]
Instructor: Drs. Theobald/Ivancic

EE 6920 Introduction to VLSI Testing [Fall 09/Fall 10]
Instructor: Dr. Abramovici
Networking and Communications

CSEE 4119 Computer Networks [Fall 09, Spring 10]

Instructor:  G. Zussman and others

Description:
• Introduction to modern computer networks.

Topics include:
• Technical foundations of the Internet
• Applications, protocols
• Local area networks (LANs)
• Algorithms for routing and congestion control
• Security
• Basics of performance evaluation
Description:
- Hands-on networking lab course.
- **Topics include:**
  - technologies and protocols of the Internet
  - CISCO routers
  - wide area networks
  - networking protocol foundations:
    - IP, ARP, ICMP, UDP, TCP, DNS, RIP, FTP, TELNET, SMTP
  - Substantial projects: putting “principles into practice”
Networking and Communications (cont.)

COMS 4180 Network Security
Description:
• Introduction to network security concepts and mechanisms.

CSEE 6180 Modeling and Performance Analysis
Description:
• Introduction to queuing analysis and simulation techniques.

COMS 6181 Advanced Internet Services
Description:
• In-depth survey of protocols and algorithms to transport multimedia info across the Internet.