

UNIVERSITY OF PITTSBURGH  
Department of Electrical and Computer Engineering

Graduate Course Announcements - Spring Term 2009-2010 (2104)  
(updated October 15, 2009)

- ECE 2140 (30040) SYSTEM-ON-A-CHIP DESIGN – Professor Jones  
3 credits, Tuesday, 5:20-7:50 pm, 370 Benedum Hall  
This course is a full semester project involving the entire class in one System on a Chip design experience. This includes requirements definition, high-level design, system specification, algorithm modeling, decomposition, IP selection and/or IP creation for re-use, synthesis simulation and testing. The system will be a true SoC with at least one processor core with associated system and application software. Lectures will be the philosophy of SoC as well as the practical issues involved in the SoC design methodology. State of the art CAD software will be used for design and co-simulation of the hardware/software platform. Prerequisite: ECE 2120 or permission of the instructor.
- ECE 2141 (37432) VALIDATION AND VERIFICATION TECHNIQUES OF DIGITAL SYSTEMS - Professor Levitan, 3 credits, Wednesday, 6:00-8:30 pm, 370 Benedum Hall  
This course presents state of the art methodologies and tools for simulation based validation and formal verification of complex digital systems implemented as a systems on a chip. Topics include testing strategies, test bench design, coverage, and model checking. Prerequisites: ECE 2140 or ECE 2121 or permission of instructor.
- ECE 2161 (30174) EMBEDDED COMPUTER SYSTEM DESIGN 2 – Professor Cheng  
3 credits, Monday & Wednesday, 4:30-5:45 pm, G26 Benedum Hall  
(30176) LAB, Wednesday, 6:00-8:50 pm, 361 Benedum Hall  
(37512) LAB, Friday, 9:00-11:50 pm, 361 Benedum Hall  
Organized as a full term project carried out by student design groups. A complex embedded system will be designed, implemented and tested using Altera and other CAD tools. Grade will be based on project reviews and the final project report. Proper design process will be emphasized. Prerequisite: ECE 2160
- ECE 2193 (32314) ADVANCED VLSI DESIGN – Professor Levitan  
3 credits, Tuesday & Thursday, 4:00-5:15 pm, 370 Benedum Hall  
(32320) LAB, TBA, 370 Benedum Hall  
This course is organized as a full semester project in conjunction with lecture material on advanced CMOS and BiCMOS digital design techniques, as well as the group design process itself. Students form groups that design and implement different VLSI projects which are then fabricated by the NSF MOSIS (MOS Implementation Service) facility and returned for testing. The majority of the course is focused on group projects with written and oral reviews and reports. Prerequisite: ECE 2192
- ECE 2195 (30042) SPECIAL TOPICS: COMPUTER ARCHITECTURE MODELING - Professor Mickle  
3 credits, Thursday, 5:20-7:50 pm, 227 Benedum Hall  
Choices of bus width, cache size, instruction width, miss penalties, etc., are usually explained in general terms with respect to existing commercial architectures. However, when designing a special purpose processor, the match of concepts from the existing architecture to the problem at hand is difficult to connect. The course will focus on problems where the architecture is required to be small and efficient due to the nature of the system constraints. Thus, class examples will be similar to the actual architecture to solve problems in this category.

- ECE 2195 (30044) SPECIAL TOPICS: MODERN COMPUTER PROCESSOR AND SYSTEM ARCHITECTURE – Professor Yang  
3 credits, Monday, 6:00-8:30 pm, G26 Benedum Hall  
This course will explore the current trends and future directions of processor and computer system architecture. The focus will be on prevailing processor microarchitecture and cache/memory designs. We will study the influence of deep submicron technology on processor designs and explore various techniques that address critical issues such as performance, power/energy consumption, thermal impact, reliability and scalability.
- ECE 2250 (19866) POWER ELECTRONICS – Professor El Nokali  
3 credits, Tuesday & Thursday, 4:30-5:45 pm, 158 Benedum Hall  
The objective of this course is to cover the fundamental concepts in the field in sufficient depth to allow students to analyze and design power electronics circuits. The course covers DC-DC converters and DC-AC converters.
- ECE 2295 (33902) SPECIAL TOPICS: SCANNING PROBE MICROSCOPY-BASED CHARACTERIZATION AND NANOFABRICATION – Professor G. Li  
3 credits, Wednesday, 6:00-8:30 pm, G28 Benedum Hall  
The course concentrates on both theoretical and practical issues of advanced scanning probe microscopy (SPM) techniques. It introduces the concepts, theoretical backgrounds, and operation principles of varieties of scanning probe microscopes; addresses the fundamental physical phenomena underlying the SPM imaging mechanism; covers the practical aspects of SPM characterization of a wide range of materials as well as operational devices; discusses SPM-based approaches to nanofabrication and nanolithography such as dip-pen nanolithography and nano-robotic manipulation.
- ECE 2372 (30112) PATTERN RECOGNITION - Professor C.C. Li  
3 credits, Tuesday & Thursday, 11:00 am-12:15 pm, 361 Benedum Hall  
Emphasis on machine pattern recognition and learning: Bayes decision theory, parameter estimation, Bayesian belief networks, discriminant functions, supervised learning, nonparametric techniques, feature extraction, principal component analysis, hidden Markov models, expectation-maximization, support vector machines, artificial neural networks, unsupervised learning, clustering, and syntactic pattern recognition.
- ECE 2390 (37434) IMAGE PROCESSING AND COMPUTER VISION – Professor C.C. Li  
3 credits, Tuesday & Thursday, 4:00-5:15 pm, G36 Benedum Hall  
This first level graduate course covers essential elements in image processing for computer vision and introductory subjects in computer vision; image segmentation: region-based, edge detection, scale space, active contours; shape description, deformable templates; textures; perspective camera model and its parameters; geometry of multiple (2) views, fundamental matrix; scene planes and homographies; consistent labeling; locating objects in 3-D space; motion analysis.
- ECE 2410 (31568) FOUNDATIONS OF WIRELESS COMMUNICATIONS – Professor Krishnamurthy  
3 credits, Monday, 12:00-2:50 pm, 404 IS Building  
Concept related to wireless communication at the lower layers of the DSI stack and some architectural issues. Broad overview of network topologies, the cellular concept and architecture, rudimentary concepts of radio propagation and multipath fading, antennas, introduction to digital modulation, error control coding in wireless systems, multiple-access schemes, and spectrum issues. Topics treated with existing systems as examples rather than as abstractions. Both mathematical and qualitative. Prerequisite: Telcom 2210.
- ECE 2523 (19328) DIGITAL SIGNAL PROCESSING - Professor Chaparro  
3 credits, Wednesday, 6:00-8:30 pm, 158 Benedum Hall

Discrete-time signal processing, discrete Fourier transform and FFT implementation, design and stability considerations of FIR and IIR filters, filter implementation and finite register effects.

- ECE 2695  
(32326) SPECIAL TOPICS: Control Theory in Neuroscience – Professors Batista & Mao  
3 credits, Monday, 4:30-5:45 pm, 227 Benedum Hall & Wednesday, 4:30-6:55 pm, G36 Benedum Hall  
Control theory has been an important tool for understanding the organization and operation of the nervous systems. This course introduces the general principles of control theory and its application in neuroscience. Topics to be covered include: signals and systems through Fourier transform; block diagrams and transfer functions, Laplace transform, state-space description, system responses; phase-lead and phase-lag compensators, PID controllers; introduction to the brain: cortex, cerebellum, brainstem, spinal cord; oculomotor control: saccades and VOR or smooth pursuit; optimal control theory; arm movement control: loads, redundant DOF, learning, internal models; human postural control.
- ECE 2774  
(30046) POWER SYSTEMS ANALYSIS 2 - Professor Kusic  
3 credits, Tuesday, 5:20-7:50 pm, G30 Benedum Hall  
Steady state phenomena, matrix transformations, system parameters, system unbalances, digital methods, and numerical analysis techniques applied to load flow, state estimators, and fault studies in large power systems.
- ECE 3232  
(37435) QUANTUM ELECTRONICS – Professor Falk  
3 credits, Tuesday & Thursday, 4:00-5:15 pm, G30 Benedum Hall  
Quantum theory of the interaction of electromagnetic radiation with matter, optical absorption and emission, lasers. Selected topics from the areas of dielectric and magnetic properties of materials. Prerequisite: ECE 2231
- ECE 3526  
MODERN SPECTRAL ESTIMATION – Professor El-Jaroudi  
3 credits, Monday, 6:00-8:30 pm, 226 Benedum Hall  
An overview of concepts of modern spectral analysis covering traditional approaches and modern estimation methods. The properties, advantages and disadvantages of each estimator will be covered in detail and demonstrated using computer experiments. Also covered are applications of spectral estimation to signal detection and beam forming. Prerequisite: ECE 2521
- ECE 3528  
(37552) TIME-FREQUENCY SIGNAL ANALYSIS – Professor Loughlin  
3 credits, Monday, 1:00-3:25 pm, G28 Benedum Hall  
This course covers the theory and application of time-varying spectral analysis. Topics include why spectra change, the AM/FM model of signals, instantaneous frequency and bandwidth, signal density functions, the short-time Fourier transform, the Wigner distribution, Cohen's class of time-frequency distributions, signal-dependent distributions and the evolutionary spectrum. Prerequisite: ECE 2523
- ECE 3776  
(37436) POWER SYSTEM CONTROL & STABILITY – Professor Kusic  
3 credits, Wednesday, 6:00-8:30 pm, G26 Benedum Hall  
The power system model for stability studies, responses to disturbances, the behavior of machines, the effect of excitation, and mathematical techniques for stability studies. Prerequisite: ECE 3775

ECE 3893  
(19336)

GRADUATE SEMINAR

1 credit, Wednesday, 12:00-1:50 pm, G30 Benedum Hall

A weekly seminar series of presentations by local industry engineers and scientists, visiting researchers, faculty and graduate students.

ECE Graduate Research and Projects

ECE 3000 and 3995 need special permission. See Sandy Weisberg in 339 Benedum Hall.

| ECE Research and Project Courses |       |       |       |       |       |       |
|----------------------------------|-------|-------|-------|-------|-------|-------|
| Faculty                          | 2997  | 2998  | 2999  | 3997  | 3998  | 3999  |
| Boston                           |       |       |       | 19338 | 19340 | 19342 |
| Chaparro                         | 29652 | 29692 | 29732 | 29792 | 29832 | 29872 |
| Chen                             | 29654 | 29694 | 29734 | 29794 | 29834 | 29874 |
| Cheng                            | 29656 | 29696 | 29736 | 29796 | 29836 | 29876 |
| El Nokali                        | 29658 | 29698 | 29738 | 29798 | 29838 | 29878 |
| El-Jaroudi                       | 29660 | 29700 | 29740 | 29800 | 29840 | 29880 |
| Falk                             | 29662 | 29702 | 29742 | 29802 | 29842 | 29882 |
| Jones                            | 29664 | 29704 | 29744 | 29804 | 29844 | 29884 |
| Kim                              | 29666 | 29706 | 29746 | 29806 | 29846 | 29886 |
| Kusic                            | 29668 | 20708 | 29748 | 29808 | 29848 | 29888 |
| Levitan                          | 20672 | 20712 | 29752 | 29812 | 29852 | 29892 |
| Li, C.C.                         | 29674 | 29714 | 29754 | 29814 | 29854 | 29894 |
| Li, G.                           | 29676 | 29716 | 29756 | 29816 | 29856 | 29896 |
| Loughlin                         | 29678 | 29718 | 29758 | 29818 | 29858 | 29898 |
| Mao                              | 29680 | 29720 | 29760 | 29820 | 29860 | 29900 |
| Mickle                           | 29682 | 27922 | 29762 | 29822 | 29862 | 29902 |
| Reed                             | 29684 | 29724 | 29764 | 29824 | 29864 | 29904 |
| Stanchina                        | 29686 | 29726 | 29766 | 29826 | 29866 | 29906 |
| Sun                              | 29688 | 29728 | 29768 | 29828 | 29868 | 29908 |
| Yang                             | 29690 | 29730 | 29770 | 29830 | 29870 | 29910 |
| Yun                              | 31174 | 31176 | 31178 | 31180 | 31182 | 31184 |