Graduate Engineering Certificate Program
in
"Computer Architecture and Networking"

Computer Architecture and Networking

The Department of Electrical and Computer Engineering (ECE) in The George Washington University School of Engineering and Applied Sciences (SEAS) introduces a new graduate engineering certificate program in "Computer Architecture and Networking". This program will provide a mechanism for practicing engineers and scientists to acquire up-to-date knowledge in the advances of computer systems architecture and networking, and in the rapidly growing use of superscalar microprocessors, real-time embedded systems, VLSI and ASIC design modules, digital signal processors, and networked computing platforms. The program is carefully tailored to provide students with necessary knowledge in all aspects of digital and microprocessor-based real-time systems and networked computing.

One-year Graduate Engineering Certificate program

This is a Graduate Engineering Certificate program *in "Computer Architecture and Networking*". It is comprised of **5 graduate courses** (4 required and 1 chosen from a set of electives), offered throughout the year so that a student can complete the certificate requirements within one calendar year. The Electrical and Computer Engineering (ECE) department M.S. program accepts all these 5 certificate courses (for those students wishing to continue towards the M.S. degree.)

Retraining, Updating, and Skills Enhancement

The program is carefully tailored to provide students with necessary knowledge in all aspects of: (1) computer systems architecture, digital and microprocessor-based systems, and symmetric multiprocessor (SMP) parallel systems; (2) computer networking concepts, architectures, and Internet protocols; (3) hardware, software, and interfacing for real-time embedded systems (using single-chip DSP controllers and microprocessors); (5) comparing and evaluating new superscalar RISC and VLIW processors; and (6) recent design techniques, algorithms, and VHDL for digital systems, system simulation at various levels, and ASIC designs.

Career Transition

This certificate program offers an alternative to a Master of Science degree (M.S.) program for professionals who wish to expand their education beyond the Bachelor's degree but might not have the time to commit to a full graduate degree program. However, the Graduate Engineering Certificate in "Computer Architecture and Networking" serves as a path towards the M.S. degree (since the M.S. program accepts all these certificate courses) in the ECE dept. GW recognizes the need for managers, professionals, and administrators to increase their skills, and to maintain a level of organizational learning. This certificate offers a forum for growth and advancement.

Prospective Candidates

Candidates interested in re-directing their careers, or expanding their abilities should explore the program's opportunities for growth, new skills and technology.

Program Prerequisites and Admission

Prerequisites:

- Applicants admitted to the ECE Graduate Certificate Program are required to have a Bachelor's Degree in electrical engineering, computer engineering, or computer science with a grade point average of at least 3.0 (on a scale of 4) or equivalent, for the last 60 credit hours of undergraduate work.
- Applicants with degrees in other disciplines and a basic knowledge of mathematics and physical sciences may be admitted with a set of deficiency courses to be determined by the faculty member acting as the Principal Advisor for this certificate program.

Admission:

- The Graduate Engineering Certificate Program will admit applicants on an open enrollment basis.
- Applicants will be subject to the same admissions process as applicants to the Master's Degree except that they will indicate their choice of Certificate Program.

Curriculum

The curriculum consists of **five courses** (4 required and a 5th chosen from a set of electives, as listed below), each carrying three academic credit hours, for a total of 15 credit hours.

Schedule and Completion

- Students can complete the 15-credit hour program and earn the *Graduate Engineering Certificate* **in one calendar year.**
- The program is designed for the part-time student – allowing students to balance this program with their careers and other activities.
- At least two courses will be offered each semester beginning in August 2001.

Certificate Award

Students will be awarded the ***Graduate Engineering Certificate*** **in "Computer Architecture and Networking"** after completion of all five of the courses in the program with at least an average grade of B and not more that 2 courses with a grade of C.

Continuation to the M.S. Program

The fifteen credit hours earned in the successful completion of the Graduate Certificate Program are fully transferable to the M.S. program of the Department of Electrical and Computer Engineering.

Principal Advisor

The ECE department faculty advisor responsible for this Graduate Engineering Certificate Program is Professor Nikitas Alexandridis.

Program Overview

a) Required Courses:

ECE 201 – Microcomputer Systems Architecture
RISC microprocessors. Superpipelined and superscalar processors. Buses, timing, and system interface protocols. Advanced memory designs. Multilevel cache designs. Architectural support for memory management, protection, task switching, and exception handling. Multiprocessor systems, reconfigurable computing, system-on-a-chip. Alexandridis and staff.
Prerequisite: ECE 182 or permission of the instructor

ECE 204: Embedded Systems
Architectural advances and instruction sets for embedded microprocessors. Real/time operating systems. Multithreaded process scheduling. Data bus architecture for real-time environments. Embedded control software. Interfacing methods and interrupt synchronization. Microcomputer-based data acquisition and control systems. Alexandridis and staff.
Prerequisite: ECE 182 or permission of the instructor

ECE 206: High-Performance Processors
Superscalar processors and instruction level parallelism. Advanced pipelines. Multiple instruction fetching, merging, scheduling, and issuing for parallel execution. Hardware and compiler solutions to data dependencies and control hazards. Branch prediction. Static and dynamic speculation. Register renaming, reorder buffers, software pipelining. VLIWs, EPIC, multithreading, etc.
Alexandridis and staff.
Prerequisite: ECE 201 or permission of the instructor

ECE 248: Introduction to Computer Networks
Fundamental communications network concepts. Architectures for access and internetworking. Data and multimedia transmission techniques, protocols; switched and shared media networks. Routing, error and flow control, TCP/IP and other Internet protocols. New developments in next generation Internet.
Pickholtz and staff
Prerequisite: ECE 144 or permission of the instructor

b) Elective Courses:

ECE 213 - Modeling of VLSI Circuits
Design techniques for large-scale digital systems, design environment, algorithms,

architectures issues, use of VHDL for system design and simulation, logic level simulation, switch level simulation, synthetic tools, timing verification. Design and simulation using commercial VLSIC CAD tools.
Zahgloul and staff.
Prerequisite: ECE 126 or permission of instructor.

ECE 294: DSP Embedded Systems
Digital signals, binary number representation, fixed-point and floating-point DSP architectures. Q-format for data representation, bit allocation and arithmetic. Portability of arithmetic expressions: floating point vs. fixed point. Applications to signal parameter estimation, signal generation, filtering, signal correlation, spectral estimation (FFT).
Doroslovacki and staff
Prerequisite: ECE 201 or permission of instructor