Polytechnic University of Puerto Rico
Department of Electrical Engineering
Master in Electrical Engineering

Course Syllabus

Course Title : Computer Architecture

Course Code : EE 6120

Credits : Three (3) credits

Duration : One academic trimester

Schedule : Forty-five contact hours per course

Prerequisites : None

Course Description

Fundamental concepts of the architectural structure and organization of computers are reviewed: fundamental execution cycle, central processing unit, input/output unit, and memory management unit are covered. Course reviews key abstractions supported at the architectural level such as virtual memory, micro-architecture, I/O controllers and processors. A historical analysis of the evolution of the major architectures from complex instruction set computers (CISC) to reduced instruction set computers (RISC) is carried out. Additional topics include performance evaluation, multiprocessing and parallel architectures, and tightly & loosely coupled distributed architectures. The architectural layer is considered in the context of compilation processes, operating systems, as well as high level programming concepts.

Justification

Computer architecture exhibits a tendency towards the development of low level mechanisms that are made visible to newer compiler and operating system optimization techniques. Hardware and software implementation technologies are evolving in a way that leads to tighter integration. Computer engineers must be aware of the functional abstraction continuum that allows functional implementation in either hardware or software and the cost-performance tradeoffs that drive their co-design.

Objectives

The main objective of the course is to prepare computer engineers with the required knowledge of computer architecture and its interaction with computer software and programming languages to be able to lead a team of hardware and software developers. Some objectives of the course are:

- Teach students about computer architectures and the importance of recognizing and understanding the different structures based on fundamental concepts that can be applied to many architectures.

- Prepare students for advanced courses on design of hardware and software.

- Help students understand how a low level program can interact directly with the computer architecture and make the most of its resources.

- Expose students to data storage mechanisms at the machine level

- Recognize the limitations and constraints of particular architectures.

- Understand software dependencies on particular architectures.

- Learn how to directly use the computer's native instructions for maximum performance.

Textbook

Computer Architecture: A Quantitative Approach (1996)
2nd Edition
David A. Patterson and John L. Hennessy
Morgan Kaufmann
ISBN: 1-55860-329-8

Course Outline

Students will learn the principles of computer architecture and their impact on performance. Course covers a variety of topics related to machine architecture and its value to computer scientists and related professions who need to understand the interaction between hardware and software:

1. Fundamentals of Computer Design

2. Instruction Set Principles and Examples

3. Pipelining

4. Advanced Pipelining and Instruction-Level Parallelism

5. Memory Hierarchy Design

6. Storage Systems

7. Interconnection Networks

8. Multiprocessors

Evaluation Criteria:

Final course grade will be determined based on the following scale:

100 – 90	A
89 – 80	B
79 – 70	C
69 – 60	D
59 - 0	F

Course History:
March 2003; Prepared by: Othoniel Rodriguez-Jimenez, P.E.,Ph.D.
March 2003; Revised by: Felix Nevarez-Ayala, P.E., Ph.D. Candidate
March 2004; Revised by: Blanca Austin, PhD

Bibliography

Computer Organization (2001)
5th edition
V. Carl Hamacher, Safwat G. Zaky, Zvonko G. Vranesic
McGraw Hill College Div
ISBN: 0072320869

Introduction to: 80X86 Assembly Language and Computer Architecture (2001)
R. C. Detmer
Jones and Bartlett Publishers, Inc.
ISBN: 0-7637-1773-8

An Assembly Language Introduction to Computer Architecture: Using the Intel Pentium (1999)
Karen Miller
Oxford University Press Inc.
ISBN: 0-19-512376-X

PCI System Architecture, Fourth Edition (PC System Architecture Series) (1999)
Tom Shanley, Don Anderson
4th edition
Addison-Wesley Pub Co
ISBN: 0201309742

Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro Processor: Architecture, Programming, and Interfacing (1999)
Barry B. Brey

5th edition
Prentice Hall
ISBN: 0139954082

AGP System Architecture, Second Edition (PC System Architecture Series) (1999)
Dave Dzatko, Tom Shanley, Inc. MindShare
2nd edition
Addison-Wesley Pub Co
ISBN: 0201700697

Pentium Pro and Pentium II System Architecture (PC System Architecture Series) (1997)
Tom Shanley, Inc. MindShare
2nd edition
Addison-Wesley Pub Co
ISBN: 0201309734

Computer Organization and Design : The Hardware/Software Interface (1997)
2nd edition
David A. Patterson, John L. Hennessy
Morgan Kaufmann Publishers
ISBN: 1558604286

Computer Architecture and Organization (1997)
3rd edition
John P. Hayes
McGraw-Hill Higher Education
ISBN: 0070273553

Computer Architecture: Pipelined and Parallel Processor Design (1995)
Michael J. Flynn
Jones & Bartlett Pub
ISBN: 0867202041

Advanced Computer Architecture: Parallelism, Scalability, Programmability (1992)
Kai Hwang
McGraw Hill College Div
ISBN: 0070316228

Introduction to Computer Architecture (1980)
2nd edition
Harold S. Stone (Editor)
Sra Publishers
ISBN: 0024179000