

## CSC 565 - COMPUTER ARCHITECTURE AND PARALLEL PROCESSING

**CREDIT HOURS:** 3

**PREREQUISITES:** Nine advanced hours of CSC (CSC 343 is recommended)

**GRADE REMINDER:** Must have a grade of C or better in each prerequisite course.

### CATALOG DESCRIPTION

Organizational and operational analysis of digital computers at the component and functional levels. Design and performance issues. Algorithms and architectures for parallel processors.

### PURPOSE OF COURSE

To study the structural and functional organization of computers and to understand the design issues and tradeoffs for Von Neumann and parallel processing architectures.

### EDUCATIONAL OBJECTIVES

The goal of this course is to have students develop the concepts and skills required to evaluate new computer design approaches and parallel processing techniques. Student evaluation will be based on successful completion of progressively more advanced laboratory problems, performance on homework assignments, and analysis of test responses.

Upon successful completion of the course, students should be able to:

1. Demonstrate knowledge of the issues and problems in computer architecture.
2. Demonstrate skills in analysis and design of new architectures based on existing and proposed systems.
3. Relate design analysis techniques to application performance requirements.
4. Identify performance enhancement issues including superscalar, superpipelined designs, caching techniques, multiple computational units, and I/O subsystems strategies.
5. Apply analysis of component interaction to performance.
6. Analyze example systems noting advantages and disadvantages, and potential for improvement.
7. Use SIMD and MIMD language support features.

### CONTENT

**Hours**

Overview of Machine Levels (Historical and Contemporary) .....	2
Computer Systems Organization .....	6
Processors, memory, I/O, classification, technology	
Conventional Machine Levels .....	3
Instruction formats, addressing, data representation, microprogramming, O/S, virtual machines	

Design trends and issues (RISC vs CISC)

Pipelining and Vector Processing ..... 8  
Principles, classification, reservation tables,  
buffers, prefetching, forwarding, hazards  
Example systems (supercomputers)

Array Processors ..... 8  
Array organization, interconnection networks,  
associative arrays  
Example systems (Illiad IV, Connection Machine)

Multiprocessors ..... 8  
Functional structures, interconnection networks and buses,  
parallel memory, concurrency, operating systems,  
interprocess communication, algorithms  
Example systems (Shared memory systems, hypercubes, Dash, CM-5)

Advanced Architectures ..... 7  
Data Flow, massively parallel, Wavefront, Systolic,  
Very Long Instruction Word (VLIW), Reduction, Symbolic  
Example systems (WARP, Mago, Multiflow)

Exams (plus final) ..... 3

TOTAL 45

**REFERENCES**

Baer, J., Computer Systems Architecture, Computer Science Press, 1980.

DeCegama, A. L., The Technology of Parallel Processing: Parallel Processing Architectures and VLSI Hardware, Vol. 1, Prentice Hall, 1989.

Flynn, M., Computer Architecture, Jones and Bartlett, 1995.

Hennessy, J., and Patterson, D., Computer Architecture A Quantitative Approach, 2<sup>nd</sup> Ed., 1995.

Hwang, K. and Briggs, F., Advanced Computer Architecture, McGraw-Hill, 1993.

Tanenbaum, A.S., Structured Computer Organization, 3<sup>rd</sup> Ed., Prentice Hall, 1990.