ELECTRICAL AND COMPUTER ENGINEERING 5504
COMPUTER SCIENCE 5504

COMPUTER ARCHITECTURE

Home Department: Electrical and Computer Engineering

PART I.

- Catalog Description:

Advanced computer architectures, focusing on multiprocessor systems and the principles of their design. Parallel computer models, programming and interconnection network properties, principles of scaleable designs. Case studies and example applications of pipeline processors, interconnection networks, SIMD and MIMD processors.

Pre: ECE/CS 4504 (3H, 3C)

- Course Number: ECE/CS 5504

- Transcript Title: COMPUTER ARCHITECTURE

PART II.

- Major, Measurable Learning Objectives

Having successfully completed this course, the student will be able to:
- Describe the strengths and weaknesses of representative contemporary computer performance metrics;
- Compare state-of-the-art computer architectures based on relevant performance metrics;
- Model and analyze interconnection network designs for parallel computer architectures;
- Analyze applications programs, formulate approaches for implementing the programs on advanced architectures, and select the most appropriate architecture to achieve a desired level of performance.

PART III. Justification

- Reason for Teaching the Course:

The study of computer architecture is crucial to the analysis, design, and integration of computer systems. Electrical and computer engineers and computer scientists must have a strong background in computer architecture in order to keep pace with rapid advances in high performance computing and applications programming. The material is relevant to both research and practice.

- Level Justification:

This course requires that students have a working knowledge of computer system design and performance concepts that are presented at the senior undergraduate level. This course expands on this knowledge base. The graduate level is most appropriate for the course sequence.

- Modification:

This course will directly replace ECE/CS 5515, which will be deleted upon approval of this course. 5515 was the first in a 2-course sequence (5515-5516) on computer architecture and networks. These two areas have diverged in recent years and thus the sequence is being restructured into separate courses. The paperwork for 5516's replacement has been submitted for approval.

- Graduate Credit:

Graduate credit for this course is requested and has been previously approved for ECE/CS 5515.

PART IV. Prerequisites and Co-requisites

This course requires that students have prior background in information representation and transfer, instruction sets, memory hierarchy, input/output organization, the von Neumann single-instruction single-data stream computer organization, basic definitions of parallel computers, and basic understanding of algorithm implementation on specific computer architectures. ECE/CS 4504 provides this background.

PART V. Texts and Special Teaching Aids

- Required Texts:

D. E. Culler and J. P. Singh, *Parallel Computer Architecture*, Morgan Kaufmann Publishers, Inc., San Francisco, CA, 1999, xxix, 1025 pp.

PART VI.   Syllabus

		Percent of Course
1.	Computer architectures, taxonomies, performance models	13%
2.	Principles of scaleable performance: parallelism conditions, flow control, partitioning, performance metrics	20%
3.	Pipelining, vector processing, superscalar architectures	13%
4.	Interconnection networks: busses, crossbars, tori, hypercube, and multistage networks, performance comparisons	13%
5.	SIMD systems: system case studies and applications	15%
6.	MIMD systems: system case studies and applications	20%
7.	Software support for massively parallel architectures	6%
		100%

PART VII.   Old (Current) Syllabus

The syllabus listed in Part VI is identical to the current ECE/CS 5515 syllabus.

PART VIII.   Core Curriculum

PART IX.   Design Justification