Global Learning Semesters
Course Syllabus
Course: COMP-614 Parallel Computer Systems
Department: Computer Science
Host Institution: University of Nicosia, Nicosia, Cyprus

Course Summary		
Course Code	**Course Title**	**Recommended Credit Hours**
COMP-614	Parallel Computer Systems	4
Semester Offered	**Contact Hours**	**Prerequisites**
Please contact us	42-45	Students are expected to have undergraduate-level knowledge in Computer Architecture. Referring to the Computer Science undergraduate-level courses offered at Intercollege, the students are expected to have covered the syllabus of COMP-335 Computer Organization and Architecture or COMP-514 Computer Architecture and Assembly Language Programming.
Department	**Level of Course**	**Language of Instruction**
Computer Science	Upper Division	English

Course Description

This course provides a comprehensive study of scalable and parallel computer system architectures for achieving a proportional increase in performance with increasing system resources. It discusses issues on general purpose and specialized parallel computers, shared-memory multiprocessors, message-passing multi computers, vector supercomputers, principles of scalable performance, MPP designs, SIMD and MIMD computers

Prerequisites

Students are expected to have undergraduate-level knowledge in Computer Architecture. Referring to the Computer Science undergraduate-level courses offered at Intercollege, the students are expected to have covered the syllabus of COMP-335 Computer Organization and Architecture or COMP-514 Computer Architecture and Assembly Language Programming.

Topic Areas

1. Parallel Computer Models, Multiprocessors (Shared-Memory), Multi computer (Distributed-Memory), SIMD or MIMD, PRAM (Parallel Random Access Machine)
2. Program Partitioning and Scheduling, Grain Sizes and Latency, Static Multiprocessor Scheduling
3. Program Flow Mechanisms, Control Flow (von Neumann) vs. Data Flow

4. Interconnection Networks (Static (BUS, mesh), and Dynamic)
5. Performance Metrics
6. Parallel Processing Applications, MPP (Massive Parallel Processing) for challenging problems, Scalability of Parallel Algorithms
7. Speedup Performance Laws, Amdahl's Law for fixed workload, Gustafson's Law for scaled problems, Memory-Bound Speedup Model
8. Scalability Analysis
9. Processors: CISC, RISC, Scalar, Super scalar, VLIW, Vector

10. Shared Memory
11. Memory Hierarchy
12. Cache Memory Organization, Cache Performance Issues, Sequential and weak consistency models

Course Assessment

Students will be assessed through a series of weekly assignments, semester project and presentation, a midterm and a final exam. The percentages contributing to the final grade are as follows:

Weekly Assignments:	10%
Semester Project and Presentation:	20 %
Midterm Exam:	20%
Final Exam:	50 %

Description of course assessment:

Weekly assignments: These will consist of questions/exercises based on the chapter covered during that week.

Project work: This will be a major project with a deadline at the end of the semester; students will be expected to present and explain their work in front of the class. Students may have the choice of selecting one of several assigned projects.

Examples of projects:

1. Read a number of assigned research papers and make suggestions for possible improvements in the existing-in-papers parallel architecture, mapping of an algorithm, memory connection/design.
2. Performance analysis through simulation (existing, modified or own) of a P-node parallel system; varying parameters like the number of nodes, cache size, bus width, processor speed or memory speed.
3. Testing and evaluating different cache coherence protocols on a particular P-node parallel system (keeping all other parameters constant) through existing, modified or own simulator.

Midterm exam: It will contain the material covered up to the time of the midterm.

Final Examination: This examination will be comprehensive and it will include all the material covered throughout the semester.

Readings and Resources

Required Textbook

- Scalable Parallel Computing, by Kai Hwang, McGraw Hill, 1998.
- Advanced Computer Architecture: Parallelism, Scalability, Programmability, by Kai Hwang, McGraw Hill, 1993.
- Parallel Computer Architecture: A Hardware/Software Approach by David E. Culler, Jaswinder Pal Singh, Anoop Gupta, Morgan Kaufmann Publishers, 1999.