Instructor: Professor S.G. Ziavras, ziavras@njit.edu, (973) 596-3462.
Office hours: By appointment (Graduate Studies Office, Fenster 140).

Description: This course deals with the design and performance evaluation of advanced/high-performance computer systems. The emphasis is on microprocessors, chip-multiprocessors and memory hierarchy design. Historical information is presented as well along with data storage and low-power dissipation schemes. Special attention is paid to pipelining, ILP (instruction-level parallelism), DLP (data-level parallelism) and TLP (thread-level parallelism) using hardware and/or software techniques to yield high performance.

Prerequisites: Undergraduate degree in Computer Engineering, or ECE 684 or equivalent.


Lecture notes and other references: http://web.njit.edu/~ziavras/classes.htm

Learning outcomes:

- Understand the inner workings and performance capabilities of advanced microprocessors.
- An ability to evaluate hardware accelerators targeting at applications with substantial data-level parallelism (DLP).
- Learn software-driven techniques to match application requirements to available pipelined hardware in order to obtain high performance.
- An ability to estimate the static and dynamic power dissipation of given hardware modules.
- An ability to design microprocessor-based systems by accounting for performance and power dissipation.
- An ability to anticipate hardware performance improvements based on established rules from past experiences with computer technology.
- Improve report-writing skills when presenting results for computer design and evaluation.
- Learn the differences among multiscalar, superpipelined, multithreaded, simultaneous multithreaded, vector, and multicore processors.
- Understand the forces behind the computer industry’s shift to multicore processors.
- Understand cache coherence issues.
- An ability to design advanced memory hierarchies.
- Understand the basic differences between shared-memory and message-passing interprocessor connection networks.
- An ability to select appropriate computer systems for given application domains.
- Understand what hardware and software problems will require solutions for future generations of multicore processors targeting at thread-level parallelism (TLP) and heterogeneous systems.
# COURSE OUTLINE

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**Grading Policy:**

- **Midterm exam:** 35% (2 hours, open book, open notes)
- **Final exam:** 35% (2 hours, open book, open notes)
- **Project:** 30% (report due in week 14)

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