

**Helen and John C. Hartmann Department of Electrical and Computer Engineering  
New Jersey Institute of Technology**

**ECE 451 – Advanced Computer Architecture I (3 credits, 3 contact**

**hours) Instructor:** Bipin Rajendran; email: bipin@njit.edu; Tel.: 973-

596-3516

**Text books** Computer Organization and Design, The Hardware/Software, 5th edition, Patterson and Hennessy, ISBN-13: 978-0124077263, ISBN-10: 0124077269

**Course Description:**

Focuses on advanced concepts in computer systems design, and the interaction between hardware and software components at various levels (i.e., hardware/software co-design). Introduces common performance measures used by hardware and software designers to facilitate comparative analysis. Main topics are: advanced pipelining, good instruction sets, CISC and RISC microprocessors, introduction to parallel computing, and a brief historical survey of computer designs.

**Prerequisite:** ECE 353

**Corequisite:** none

**Specific course learning outcomes (CLO):**

The student will be able to:

1. Understand advanced concepts in computer systems design, and explain the interaction between hardware and software components at various levels
2. Understand and utilize the common performance measures used by hardware and software designers to facilitate comparative analysis;
3. Quantitatively evaluate and compare design of advanced pipelining, good instruction sets, CISC and RISC microprocessors, and parallel computing systems;
4. Understand the historical context of computer system designs and future trends.

**Relevant student outcomes (ABET criterion 3):**

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-3)
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors (CLO 4)
3. an ability to communicate effectively with a range of audiences and use engineering judgment to draw conclusions (CLO 3, 4)
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1-4).

**Computer assisted design and course specific software:**

SPIM, VHDL

<b>Tentative Course Schedule</b>	<b>Weeks</b>
Introduction, Instruction Set Architecture	1
SPIM, SimpleScalar demo	2
Computer Arithmetic	3-4
Performance evaluation	5
CPU datapath and control	6-7
Pipelining	8-9
Memory Hierarchy	10-11
I/O Design	12-13
Parallel computing and Multiprocessors	14

**Grading policy:** Homework + Quizzes & Class Participation - 20%, Programming assignments/mini-projects - 25%, Midterm Exam - 25%, Final Exam - 30%

**Homeworks and projects**

SPIM and VHDL based simulations of computer architecture modules and concepts

**Updates and Assignments** to be distributed via Moodle

**Office hours, recitations and group studies:** By appointment

**Honor Code:** The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.

**Office:** ECE Bldg., Room 327

**Prepared by:** B. Rajendran