

Department of Electrical and Computer Engineering

New Jersey Institute of Technology

ECE 451 - Computer Systems Design (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 students - ECE 353, instructor permission **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, 2, 3,4)
- (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 2, 3, 4)
- (3) an ability to communicate effectively with a range of audiences (CLO 4)
- (4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (CLO 3,4)
- (6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLO 2, 3)
- (7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies (CLO 1, 2, 3, 4)

Computer assisted design and course specific software:

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.

SPIM, VHDL

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.

Tentative Course Schedule	Weeks
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

This course outline serves to provide a big picture of the course. Instructional materials such as textbooks, individual topics, and grading policy are subject to revision and changes by individual instructors.