William Paterson University of New Jersey
Department of Computer Science
College of Science and Health
Course Outline

1. TITLE OF COURSE AND COURSE NUMBER:
   Digital Logic and Computer Organization, CS341 Credits: 3

2. DESCRIPTION OF THE COURSE: This course introduces the principles of design and analysis of digital components found in digital systems. It also discusses the design of functional units and how these units are organized into a computer system. Other topics such as typical architectures of computer system, VLSI technology, digital design software tools will also be introduced.

3. COURSE PREREQUISITES: CS260 and CS280 with grades of C- or better

4. COURSE OBJECTIVES:

   To learn the principles of logic design and the organization of a computer.

   To learn the functions of a computer at gate, register, and processor levels.

   To learn the analysis and design of the combinational and sequential logic circuits.

   To become familiar with the major components of typical organization of modern computer systems.

   To introduce the state-of-the-art VLSI technology and its impact on computer design.

5. STUDENT LEARNING OUTCOMES:

   Upon completion of the course, students will be able to:

   a) Recognize the nature and characteristics of digital logic and computer organization.
   b) Recognize various kinds of number systems and the conversion among them.
   c) Understand Boolean algebra and its application on digital logic.
   d) Analyze and design digital logic.
   e) Use logic simulator, the software tool for digital logic design.
   f) Identify major components of computer organization.
   g) Identify the new trends and technologies of digital logic and organization.

Through classroom discussions, and various homework, term papers, team lab projects, and other assignments, the course also reinforce the students learning outcomes of the university:

a) Effectively express themselves in written and oral form. Measure: exams, homework and projects.
b) Demonstrate ability to think critically. Measure: exams, surveys, and projects.
c) Locate and use information. Measure: projects.
d) Demonstrate ability to integrate knowledge and idea in a coherent and meaningful manner. Measure: exams, surveys, and projects.
e) Work effectively with others. Measure: surveys and projects.

6. TOPICAL OUTLINE OF THE COURSE CONTENT:

Topic 1: Number Systems
- a) Binary, octal, decimal, and hexadecimal number systems
- b) Number base conversions
- c) Negative numbers and complements
- d) Floating number representation and standards
- e) Decimal codes

Topic 2: Boolean Algebra and Gate Network
- a) Boolean algebra
- b) Boolean functions and their simplification
- c) Digital logic gates
- d) Implementations of Boolean functions
- e) IC digital logic families

Topic 3: Combinational Logic
- a) Design and analysis procedures
- b) Typical combinational circuits
- c) Programmable logic array (PLA), programmable array logic (PAL), and field programmable gate arrays
- d) The read-only memory (ROM) in logic design

Topic 4: Sequential Logic
- a) Flip-flops and clock
- b) Registers and register operations
- c) Typical sequential circuits
- d) State diagram and state tables
- e) Design and analysis of sequential circuit

Topic 5: The memory system
- a) The memory hierarchy and organization
- b) Random access memory (RAM)
- c) RAM organization and operation

d) Other memory technologies
e) Error detection and correction

Topic 6: The Arithmetic Logic Unit (ALU)
a) Integer and floating point data representations
b) Adders, subtractors, multipliers, and dividers
c) Logic and other operations
d) Organization of the ALU

Topic 7: The Control Unit (CU)
a) Micro operations
b) Control of the CPU
c) Hard-wired implementation
d) Microprogrammed control

7. GUIDELINES/SUGGESTIONS FOR TEACHING METHODS AND STUDENT LEARNING ACTIVITIES:
   a) Classroom lectures, discussions, and problem-solving sessions.
   b) Homework reviews and pre-exam reviews.
   c) Projects.

8. GUIDELINES/SUGGESTIONS FOR METHODS OF STUDENT ASSESSMENT (OUTCOMES):

   a) Periodic examinations, quizzes, and the final examination
   b) Software and/or hardware projects
   c) Term papers.

9. SUGGESTED READINGS, TEXTS, OBJECTS OF STUDY:
   Logic and Computer Design Fundamentals,.3rd edition, M. Mano and C. R. Kime, Prentice Hall 2004.

10. BIBLIOGRAPHY OF SUPPORTIVE TEXTS AND OTHER MATERIALS:

Digital Design: Principles and Practices, 4th edition, John F. Wakerly, Prentice Hall 2006

Logiworks 4: Interactive Circuit Design Software, Capilano Computing systems, Addison Wesley, 1999

Fundamentals of Digital Logic with VHDL, 2nd edition, Steven Brown and Zvonko Vranesic, McGraw Hill 2004.

Contemporary Logic Design, 2nd edition, Randy H. Katz and G. Borriello, Prentice Hall 2005.

VHDL: A Starter's Guide, 2nd edition, Sudhakar Yalamanchili, Prentice Hall 2005

VHDL Primer, A, 3rd edition, Jayaram Bhasker, Prentice Hall 1999

Introduction to Logic Design with CD ROM, 2nd Edition, Alan B Marcovitz, McGraw Hill 2005

Computer Architecture and Logic Design, Thomas C. Bartee, McGraw Hill 1991.

Computer Architecture: Single and Parallel Systems, Mehdi R. Zargham, Prentice Hall 1996.

Digital Design from Zero to One, Jerry D. Daniels, Wiley, 1996.

Fundamentals of Logic Design (5th edition with CD-ROM), Charles H. Roth, Thomson, 2003.

Computer Organization and Architecture, 7th edition, William Stallings, Prentice Hall 2006.

11. PREPARER'S NAME AND DATE: Dr. E. Hu

12. ORIGINAL DEPARTMENTAL APPROVAL DATE: Spring, 1996

13. REVISERS' NAME AND DATE: Drs. E. Hu and B. Su

14. DEPARTMENTAL REVISION APPROVAL DATE: Spring 2005