1. **Professor** : Haldun Hadimioglu  
   Office : 10.009 2MTC  
   Tel : (718) 260-3101  
   Fax : (718) 260-3609  
   haldun at nyu dot edu  
   http://cis.poly.edu/haldun

2. **Course format** :  
   **Lecture** : 1919  
   **Lab Sections** :  
   ➡ A (1920, Thursday 9 - 11:50)  
   ➡ B (1921, Tuesday  9 - 11:50)  
   ➡ C (1922, Friday 1 - 3:50)  
   ➡ D (1923, Friday 4 - 6:50)

3. **Prerequisite** : CS1114 (C- required) or CS1133 (C- required).

4. **Course web page** : http://cis.poly.edu/cs2204  
   ➡ Course handout and lab files are at the course web site

5. **CS2204** is the first course on digital hardware, with an emphasis on designing chips!

6. **Textbook and manuals** :  
   ➡ Author’s web site : [http://www.ddpp.com](http://www.ddpp.com) for additional material.  
   ➡ The course ID to access CS2204 OneKey CourseCompass will be given in class

   **Chip manuals** :  
   ➡ Texas Instruments Digital Logic Pocket Data Book, 2007, SLL  
   ➡ Motorola FAST and LS TTL Data, 5th edition, 1992 : On reserve in the library

7. **CS2204 Lab** :  
   Students learn practical aspects of digital logic and apply them by working on a term project in the lab. The term project is developing a game chip:  
   ➡ The lab helps students understand subjects discussed in class better. Practicing in the lab, i.e. actually designing digital circuits, reinforces and complements what students learn in the classroom. *Students who attend labs are faster at solving problems.* Also, the lab emulates the engineering design environment where engineers are teamed up to design digital circuits piece by piece under the guidance of a project manager.
The lab introduces current digital design tools and techniques, such as computer aided design (CAD) tools, field programmable gate array (FPGA) prototyping, top-down, team-oriented, core-based design. The game chip will be developed on Xilinx ISE 12.4 CAD tool and the Digilent NEXYS-2 FPGA board. Students will install a smaller version of the ISE 12-4, WebPACK 12.4, on their laptops to work on the project.

The lab is 227RH which is a CSE lab. Each section has two hours and 50 minutes a week in the lab. Students cannot attend the lab of other sections. Also, 227RH will be open to CS2204 students with a TA present (open lab hours) starting week 4.

The term project is distributed to six design experiments, each making use of previous experiments. Consequently, experiments are increasingly more complex. 3- or 4-student teams are formed by the third week of the semester. Team members work on design experiments and do the homework assignments together until the end of the semester. All six experiment designs will be collected one per team and graded. Late submissions will not accepted. Students must be present and work well with their partners in the lab. Attendance is recorded in every lab session. If a student does not attend lectures or labs, he/she will be separated from the team.

Lab sessions start with a presentation by the professor. Then, students work on their experiments. The lab affects the term grade. How to determine the lab grade will be given in the lab.

8. Homework:
There will be six homework assignments. The homework will be submitted by teams. A late submission will not be accepted. The CourseCompass web site has solutions of some of the textbook problems.

Students who do the homework are faster at solving problems. Showing work (intermediate steps) is required to get full/partial credits on a question. The homework is graded by a TA. Although, the homework will not affect the term grade, it can help raise grades as explained below.

Homework assignments have modified past exam questions and answers to help learn chapters and solve homework problems. Students need to study them before they solve homework problems, not before exams. Note that, these past exam questions are samples and do not give hints about exams this semester.

9. Exams:
There will be two 110-minute midterm exams and a three-hour final exam. The exams will cover class and lab topics.

Showing work (showing intermediate steps) is required to get full credits on a question. That is, both the final answer and the steps to get it, the approach, are important.

The steps are given in class and past exam solutions. Thus, students are expected to solve exam questions as such. Showing the approach also helps students acquire and improve their documentation skills, critical for the technical world.

In order to facilitate this, the exams are open book exams: Students can use their own material, i.e. their books, notebooks, homework and handouts during the exams. Note that once the exam starts there is no sharing.

Students must prepare for the exams as if they are closed book exams!
In addition, remembering the following is needed during the exams:

- No multiple answers to a question,
- Precise answers to questions, no answers like “the rest is similar,”
- Answering the question asked, and
- Use the exam booklet space well: For example, start a new question on a new page.

10. Term Grade:
Labs and homework considerably affect the term grade whose numerical calculation is as follows:

\[
\begin{align*}
5\% & \text{ Labs} & 25\% & \text{ Exam I} & 25\% & \text{ Exam II} & 45\% & \text{ Final Exam}
\end{align*}
\]

- To earn 5% for the Labs, students must work well in the lab (attendance, concentration and cooperation) and do their term project well.
- The homework does not affect the term grade directly but it is taken into account when a student’s term grade is near a grade “border.” Also, taken into account are attendance and lab performance. If they are good, the grade is raised. Finally, the professor may change the term grade computation. Thus, students are strongly suggested that they fulfill the requirements of the course, i.e. lectures, labs and homework assignments.

11. Office Hours:
The professor has an open-door policy that if he is not busy, students can ask questions in his office. If the door is closed, he might be teaching or at a meeting. If a student wants to see the professor at a certain time, he/she makes an appointment with the professor.

- Students can use email. But, they are strongly suggested that they see the professor to ask questions, instead of sending email. If email is sent, a Polytechnic email address must be used and student’s name and section must be included. Broadcast messages will be sent to the class to make announcements. Note that grades are not given out to students via email or telephone. Students need to see the professor to learn their grades.
- There are TAs to help students in the lab. TA assignments and their contact information will be given at the course web site and in class and lab handouts later in the semester.

12. References:
Students are suggested that they study recent digital logic books since the field advances rapidly. The books below are recommended with respect to their relevance to the course and the textbook:


- A book giving insight on microprocessor design from the concept phase to the production
phase:


⇒ A book describing how and why technical work involved in computer design and development is just a small part of a larger picture with emotions, ambitions and conflicting goals of many people involved:


13. Material Coverage:
All chapters will be covered, some partially, some completely. Students will be given additional material in class. The tentative schedule is as follows:

<table>
<thead>
<tr>
<th>Days</th>
<th>Subject</th>
<th>Chapter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 28</td>
<td>Introduction. Course overview</td>
<td>1</td>
</tr>
<tr>
<td>28, 30, Feb 4, 6</td>
<td>Number systems and binary arithmetic</td>
<td>2</td>
</tr>
<tr>
<td>Feb 6, 11, 13, 18, 20, 25, 27</td>
<td>Overview of digital hardware. Gates. Combinational circuit analysis and design by using popular combinational circuits and gates</td>
<td>3, 4, 6</td>
</tr>
<tr>
<td>Mar 6</td>
<td>EXAM I</td>
<td>HW : 1, 2 ; Labs : 1 - 4</td>
</tr>
<tr>
<td>Feb 27, Mar 4, 11, 13</td>
<td>Synchronous sequential circuit fundamentals, analysis and design by using popular sequential circuits. Digital systems: Introduction to state machine design, Datapath and Control Unit design</td>
<td>7, 8</td>
</tr>
<tr>
<td>Apr 3</td>
<td>EXAM II: Cumulative</td>
<td>HW : 1 - 4 ; Labs : 1 - 8</td>
</tr>
<tr>
<td>Mar 25, 27, Apr 1, 8, 10</td>
<td>Switching Algebra. Combinational circuit fundamentals, analysis and design by using gates and Switching Algebra, Karnaugh maps</td>
<td>4</td>
</tr>
<tr>
<td>Apr 10, 15, 17, 22</td>
<td>Synchronous sequential circuit components, flip-flops, sequential circuit analysis and design by using flip-flops</td>
<td>7, 8</td>
</tr>
<tr>
<td>Apr 22, 24, 29</td>
<td>Semiconductor memory chips, ROM. Combinational programmable logic devices, PLA and PAL. Coding, error detection and correction. Hamming Code</td>
<td>2, 6, 8, 9</td>
</tr>
<tr>
<td>May 1</td>
<td>Introduction to the VHDL language and programming</td>
<td>5, 6, 7, 8</td>
</tr>
<tr>
<td>TBA</td>
<td>Final exam: Cumulative. All the above chapters</td>
<td>HW : 1 - 6 ; Labs : 1 - 13</td>
</tr>
</tbody>
</table>

14. ABET Outcomes:
CS2204 addresses the following ABET a-k outcomes:

a) Students apply mathematics knowledge and engineering knowledge to design and analyze advanced circuits.

c) Students design a digital system that meets the desired chip count, speed and cost contraints.

e) Students identify, formulate and solve circuit problems.

k) Students gain techniques, skills and modern engineering tools necessary for engineering practice by applying them on the term project.
15. Reminders about the course:
Students are required to read the web pages whose links are provided with at the course web site:

1) **NYU-Poly Code of Conduct** web page: http://engineering.nyu.edu/academics/code-of-conduct

2) **NYU-Poly Life page** web page with links to Health+Wellness, Campus Safety, Students Resources and other: http://engineering.nyu.edu/life. In addition, keep the following in mind:

a) Always keep contact with the professor and discuss your personal matters in professor’s office.

b) A successful course experience: To enjoy the course as much as possible and be ready for the follow up courses, students need to be committed to the course

  ➞ Attending classes and labs and doing the work are needed.
  ➞ Lectures are dependent on each other and labs are also dependent on each other.
  ➞ Study the notes, books, handouts. But, just reading does not mean studying! Also, do the homework and term project!

c) Students must realize that every action they take has consequences. They also should **not** make assumptions and decisions on the course (the exams, lectures, labs, the homework and attendance) without asking the professor. An assumption that is often made by students is that every course is the same. This is not the case!

d) A reason for a low grade is **missing classes** and **labs**. Even if one gets the notes, it does **not** help. This is because:

  ➞ The notes taken from the board may not be correct.
  ➞ Someone taking the notes may not write down all the verbal comments and suggestions made by the professor.
  ➞ Attending classes and labs forms better memory because of visual (seeing the writing on the board), audio (listening to the professor) and tactile (writing down the notes) inputs.
  ➞ During lectures and labs, the professor refers to earlier lectures and labs (past topics, comments, suggestions, etc.) which refreshes students’ memory and further reinforces their knowledge.

Overall, students learn and remember more. Finally, since their memory is fresh, students save time when they study for exams.

e) Missing an exam is **not** a minor case. A careful assessment is made to excuse a student or to grant an incomplete to a student. The professor makes the decision. The decision is made also based on the information by the student’s academic department and the Student Affairs Office.

One of the requirements to excuse a student is that at the time the student is not able to take the exam, he/she **be in good standing in class**, i.e. has good attendance, a good homework performance, a good lab performance and a good exam performance: The professor wants to see that the student has been committed to the course and learning the material has been his/her main objective.

A student who is excused from a midterm exam is **not** given a make-up exam. The weight of the midterm exam is distributed to the other exams at the discretion of the professor. The make-up exam for the final exam will be harder than the one given to the whole class.

If a student experiences **any** problem, including health/personal problems, he/she must immediately contact Judith Simonsen who is the director of the Student Development Office: jsimonse@poly.edu. Her number is (718) 260-3046. Her office number is LC 240C.

f) For a course, the semester is over when the final exam is over. Students are **not** given extra work, a project, a make-up exam or any other kind of special treatment to raise their grade during or after the semester.
g) Some students do not know/follow NYU-Poly and CS2204 rules and regulations nor seek advice from Polytechnic staff. Students are strongly suggested that they speak with the professor, the TAs, the major advisor, the personnel of the Student Affairs Office, and the Counseling Center.

16. Professor’s message:
- Focus on learning and thinking!
- More importantly, focus on motivating yourself to learn more and think more!
- Knowledge is not finite!
  - As a student, you will use your motivation to learn and think to learn more of each topic!
  - Students consider the learning and thinking style shown on the left not the one on the right:

<table>
<thead>
<tr>
<th>Learning, thinking and motivating yourself? WHY?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
</tr>
<tr>
<td>Learn</td>
</tr>
<tr>
<td>Learn</td>
</tr>
<tr>
<td>Motivation is needed to keep the cycle going</td>
</tr>
<tr>
<td>Joy</td>
</tr>
<tr>
<td>Knowledge is not finite &amp; the world is not predictable</td>
</tr>
<tr>
<td>Learn</td>
</tr>
<tr>
<td>Memorize</td>
</tr>
<tr>
<td>Past exams, handouts, etc.</td>
</tr>
<tr>
<td>No thinking, no discovery &amp; no joy</td>
</tr>
<tr>
<td>Knowledge is finite &amp; the world is predictable</td>
</tr>
</tbody>
</table>

- Students are suggested that they read the following book that describes the cycle on the left above:

17. Benefitting from the course for the years before and after graduation:
- Industry and academia look for graduates who can solve problems, are systems oriented and creative
  - In order to accomplish those you need to have
    - Analytical skills, synthesis skills and team work skills
  - For these three skills, you will need to develop critical thinking and personal skills for which you need to do the following
    - Learning is your target!
  - You interact with people to work on a problem, to exchange ideas, to help, etc.!
  - After graduation, the most common way you will be judged is how you write
    - Concentrate on documentation!
  - Homework and exams help you practice writing: Students show work, not just the final answer
- Students understand and satisfy goals of the course which are intellectual, technical and non-technical:
  1) The intellectual goals are that students learn how to learn fast and are critical thinkers. This is necessary during one’s lifetime.
  - The more you learn, the better for you. That is, do not go for the grade!
  2) Technical goals are for a successful technical career: Acquiring skills to be systems oriented and a problem solver as well as acquiring the necessary course content which is digital logic:
    - Main technical topic: Theory, design and analysis of digital circuits. Digital circuits are building blocks of digital systems such as microprocessors and computers
    - Digital system fundamentals are covered in the context of state machine design and the term project.
  3) The non-technical goals include acquiring and improving skills needed for interacting with and managing people in various environments. They are needed in the technical world which is team-based and becoming more global.