

McMaster University

Electrical and Computer Engineering Department

CE 4EK4 Microelectronics - Fall 2009

- Instructor:** Prof. M. Jamal Deen, CRL 226, Tel: 525-9140, ext 27137; E-mail: jamal@mcmaster.ca
- Teaching Assistants:** Please e-mail the course instructor or the TA, to make an appointment outside of office hours, for any questions or concerns. The TA will set aside two 2 each week as office hours.
- Class Times:** Monday and Wednesday, 17:30 to 18:20, T13 105
- Tutorials:** Wednesdays, 12:30 to 13:20, T13 123
- Project Times:** Mondays, 14:30 to 15:20, ITB AB107
- Office Hours:** One hour immediately after each class or by appointment.
- Course Objectives:** This course is concerned with integrated circuit or chip - design, simulation and layout. Specific topics addressed are - CMOS and MOSFET integrated circuit design; fabrication and layout; simulation; digital and analog circuit blocks; computer aided design and analysis; testing and verification.
- Prerequisite:** ELEC ENG 3EJ4 or 3FB3 or 3FC3; **Antirequisite:** ELEC ENG 4FD3
- Textbook:** R.J. Baker, CMOS Circuit Design, Layout, and Simulation, Second Edition, Wiley-IEEE Press, 2005. ISBN 0-471-70055-X (see <http://cmosedu.com/cmos1/book.htm>).

Detailed Course Outline:

The course material will be from the class text and other sources such as the texts listed in the references section. It is the students' responsibility to be know in detail the material discussed in class.

- Electronic design
- LASI, Layout System for Individuals, <http://members.aol.com/lasicad/> and <http://members.aol.com/lasicad/candr.htm>
- Layout of CMOS layers. CMOS technology
- Layout of MOSFETS, MOSFET operation and Modelling. BSIM model
- Passive elements - resistor; capacitor and inductor - layout; temperature and voltage dependence of components
- CMOS logic inverter design
- Static logic gate and cell design
- Transmission gate, flip-flops, and dynamic logic gates
- VLSI layout
- Memory devices and circuits
- Special digital circuits. Dynamic analog circuits

Project: The project involves the design and detailed analysis, modelling and simulation of a digital or simple analog integrated circuit for a specific purpose or application. Please consult the instructor very early for possible projects and what is expected. Each student must submit an individual project report. You are to utilize the lab times to work on your project. Download WinSPICE from <http://www.winspice.co.uk/> or PSPICE from <http://www.electronics-lab.com/downloads/schematic/013/>

The detailed project report is due on Wednesday 2 December 2009 at 5 pm.

Grading: Mid-terms - 20% Tutorials – 20% Project - 40% Final Exam - 20%

- References:**
- R.C. Jaeger, Microelectronic Circuit Design, McGraw-Hill, 97.
 - A. Sedra and K. Smith, Microelectronic Circuits 4th ed., Oxford, 97.
 - W. Buchanan, Microelectronic Systems, Wiley, 97.
 - J.M. Rabaey, Digital Integrated Circuits - A Design Perspective, Prentice Hall Electronics and VLSI Series, 96
 - R.L. Geiger, P. Allen & N. Strader, VLSI Design Techniques for Analog & Digital Circuits, McGraw-Hill, 90
 - D.A. Hodges and H.G.Jackson, Analysis and Design of Digital Integrated Circuits, 2nd ed., McGraw-Hill, 88.
 - L.A. Glaser & D.W. Dobberpuhl, The Design and Analysis of Digital Integrated Circuits, Addison-Wesley, 85.
 - N. Weste, K. Eshraghian, Principles of CMOS VLSI Design, Addison-Wesley, 85.
 - D.A. Pucknell, K. Eshraghian, Basic VLSI Design: Systems and Circuits, Prentice Hall, 88.
 - T.A. Dillinger, VLSI Engineering, Prentice Hall, 88.
 - S. Kang and Y. Leblebici, CMOS Digital Integrated Circuits, McGraw Hill, 96.

Policy Reminders: Senate and the Faculty of Engineering require all course outlines to include the following reminders: “The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.”

“Students are reminded that they should read and comply with the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty as found in the Senate Policy Statements distributed at registration and available in the Senate Office.”

“Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at

http://www.mcmaster.ca/senate/academic/ac_integrity.htm

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

In this course we will be using a software package designed to reveal plagiarism. Students will be required to submit their work electronically and in hard copy so that it can be checked for academic dishonesty.”

Note on Calculators: The McMaster Standard Calculator (Casio FX991) may be used on tests and examinations.

Assignments for practice

Please use the previous exams at the end of the course as practice problems and the problems at the end of the relevant chapters in the text.

Exams: #1- Wednesday 14 October 2009

#2- Monday 11 November 2009

All in-class exams are open book and open notes. However, no computers are allowed.

Most likely, the final exam will be a take-home exam.