

EE 2EI5 – Electronic Devices and Circuit I

Instructor: Prof. Chih-Hung (James) Chen

Office: ITB-A321

Tel: (905) 525-9140 ext. 27084

E-mail: chench@mcmaster.ca

URL: <http://www.ece.mcmaster.ca/~chihhung/Course/EE2EI5/ee2ei5.html>

Course Notes:

Course notes are available on the web site at

http://www.ece.mcmaster.ca/~chihhung/Course/EE2EI5/Notes/ee2ei5_notes.html

Text Book:

[Microelectronic Circuits](#) by A. S. Sedra and K. C. Smith, Oxford University Press, 6th edition, 2010, ISBN-978-0-19-532303-0.

Reference Books:

1. Microelectronic Circuit Design, R. C. Jaeger, 2nd Edition, 2004, McGraw-Hill, ISBN-0-07-232099-0.

2. Computerized Circuit Analysis Using SPICE Programs, B. M. Wilamowski and R. C. Jaeger, 1997, McGraw-Hill, ISBN-0-07-032484-0.

Note: PSPICE can be accessed from CIS Computing Lab. JHE-233/234, or from the accompanying CD with the textbook. For more information, please visit:

<http://www.cadence.com/orcad/index.html>

or <http://www.engr.uky.edu/~cathey/pspice061301.html>.

Course Description:

Semiconductor devices and electronic circuits; electrical characteristics, principles of operation, circuit models of diodes, field-effect and bipolar transistors, and operational amplifiers; analysis and design of basic application circuits.

Prerequisites:

ELEC ENG 2CI4 or 2CI5.

Antirequisites:

ELEC ENG 2EI4.

Course Load:

3 lectures, one tutorial, and one 3-hour lab every week, one term

Course Objective:

To understand the basic physical structure, principles of operation, electrical characteristics and circuit models of the most important semiconductor devices, and to be able to use this knowledge to analyze and design basic electronic application circuits. To extend the understanding of how electronic circuits and their functions fit into larger electronic systems.

Course Outline:

1. Introduction (3 lectures)

components, circuits, and signals, linear circuit and superposition theorem, two-port network model, source, and load

2. Operational amplifiers (3 lectures)

ideal operational amplifier model, analysis of circuits containing ideal operational amplifiers, and simple circuit design by utilizing ideal operational amplifiers

3. Solid-state diodes and diode circuits (6 lectures)

structure and I-V characteristics, ideal diode model, constant voltage drop model, and diode circuit analysis, and diode circuit applications (rectifiers, wave-shaping circuits, and simple diode logic)

4. Field effect transistors (3 lectures)

structures and I-V characteristics, biasing techniques, and scaling effect

5. Field effect transistor circuits and analyzing techniques (9 lectures)

CMOS inverter and its static and dynamic characteristics, CMOS NOR and NAND gates design of complex gates in CMOS DC and small signal analysis of linear amplification circuits, linear amplification circuits based on difference FET configurations, current sources and MOS current mirror

6. Bipolar junction transistors (3 lectures)

structure and I-V characteristics, and biasing techniques

7. Bipolar junction transistor circuits and analyzing techniques (9 lectures)

emitter coupled pair and ECL gate, ECL OR-NOR gate, TTL logic, BiCMOS logic, DC and small signal analysis of linear amplification circuits, linear amplification circuits based on different BJT configurations, and BJT current mirror

*Solid-state electronics (supplementary reading #1 A brief introduction to physics behind the semiconductor material and P-N junction)

(Total Course = 36 Lectures)

Laboratory Experiments:

Lab 1: Introduction to instruments (Part II, Set 1 in lab manual)

Lab 2: PSpice experiment for OpAmp filters (Part I, Set 6 in lab manual)

Lab 3: PSpice experiment for diode circuits (Part I, Set 7 in lab manual)

Lab 4: Diodes and Op Amp circuits (Part II, Set 2 in lab manual)

Lab 5: PSpice experiment for basic MOSFET circuit (Part I, Set 9 in lab manual)

Lab. 6: CMOS circuits and amplifiers (Part II, Set 3 - part A & B only, and Set 4)

Lab. 7: PSpice experiment for BJT amplifiers (Part I, Set 12 in the manual)

Lab. 8: BJT circuits and amplifiers (Part II, Set 5 in the manual)

Course Format:

Full class sessions (36 hours):	3 hours per week for 12 weeks
Tutorial sessions (10 hours):	1 hour per week for 10 weeks (starting from the 2nd week)
Laboratory sessions (24 hours):	3 hours every week for 8 weeks
Pre-lab. preparations (8 hours):	1 hour every week for 8 weeks
Assignments (24 hours):	3 hours every week for 8 weeks
Study time (24 hours):	3 hours per week for 12 weeks
Total loading:	~14 hours per week

Assessment:

Laboratory:	16% (8 labs, each laboratory has 2 points, 16 points in total)
Assignment:	16% (8 assignments, each assignment has 2 points, 16 points in total)
Mid-term test:	18% (2 tests, 3 questions in each test, 3 points for each question, 18 points in total)
Final exam:	50% (5 questions, each has 10 points, 50 points in total)

Lecture Time:

Tuesday, Wednesday, and Friday: 12:30 ~ 13:20, ITB/AB102.

Tutorial Time:

Monday: 9:30 ~ 10:20, T13/125.

Thursday: 9:30 ~ 10:20, T13/127.

Office Hours:

By Appointment

Academic Dishonesty:

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.

Important Notes:

* PLEASE NOTE THAT ANNOUNCEMENTS CONCERNING ANY TYPE OF GRADED MATERIAL MAY BE IN ANY FORMAT (E.G., ANNOUNCEMENTS MAY BE MADE ONLY IN CLASS). STUDENTS ARE RESPONSIBLE FOR COMPLETING THE GRADED MATERIAL REGARDLESS OF WHETHER THEY RECEIVED THE ANNOUNCEMENT OR NOT.

* THE INSTRUCTOR RESERVES THE RIGHT TO CHOOSE THE FORMAT OF ANY DEFERRED MIDTERMS OR DEFERRED FINAL EXAMS (I.E. FORMAT MAY BE WRITTEN OR ORAL).