ELEC ENG 2EI5
Electronic Devices and Circuits I
Winter 2017
Course Outline

CALENDAR/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.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): ELEC ENG 2CI4 or 2CI5
Antirequisite(s): ELEC ENG 2EI4

SCHEDULE

Lectures: Monday, Wednesday, Thursday 1:30 – 2:20 p.m.
Tutorial: Friday 9:30 – 10:20 a.m.

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Aleksandar Jeremic
ITB A214
Jeremic@mcmaster.ca
ext. 27894

Office Hours:
Wednesdays 11:30am–12:30pm
Or by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn

COURSE OBJECTIVES

1. Be able to specify the iv-characteristics of diodes, MOSFETs, and BJTs graphically and analytically.
2. Be able to identify device parameters from data sheets for diodes, MOSFETs, and BJTs.
3. Be able to Extract device parameters from iv-characteristics for diodes, MOSFETs, and BJTs.
4. Analyze DC or large signal currents & voltages in circuits containing diodes, MOSFETs, and BJTs.
5. Identify, describe behavior, and design standard diode, MOSFET, and BJT circuits for level shifting, limiting, clamping, rectification, biasing, and digital logic.
6. Calculate static and dynamic properties of NMOS and CMOS logic gates.
7. Design complex CMOS gates, including proper transistor sizing.
8. Calculate small signal currents and voltages in circuits containing diodes, MOSFETs, and BJTs.
9. Be able to Identify, describe behavior, and design standard MOS and BJT amplifier topologies and design single stage MOS and BJT amplifiers.
10. Be able to tepresent the small signal behavior of amplifier circuits using two port models.

ASSUMED KNOWLEDGE

- Algebra, trigonometry, functions, and calculus
- Analysis of RLC circuits in time domain using mesh, nodal, Thevenin and superposition techniques

COURSE MATERIALS

Main References:

Required Texts

- Sedra & Smith. Microelectronic Circuits. Oxford Universtiy Press, 7th ed.
  - This is available in print edition from the Campus Store
  - It is also available as a digital 360 day rental from Course Smart, http://www.coursesmart.com/9780199339136

Reference Texts

- R.C. Jaeger and T.N. Blalock. Microelectronic Circuit Design. McGraw-Hill. Neaman. Electronic Circuit Analysis and Design. McGraw-Hill.
- B.M. Wilamowski and R.C. Jaeger. Computerized Circuit Analysis Using SPICE Programs. McGraw-Hill.

Other Supplies

- Supplies for Labs & Projects TBA
- Lectures posted on avenue

Calculator:
Only the McMaster Standard Calculator will be permitted in tests and examinations. This is available at the Campus Store.

COURSE OVERVIEW

Week	Topic	Readings
1	Revew of Basic Concepts and Equivalence	
2	Diodes	Sedra/Smith &4
3&4	Mosfets	Sedra/Smith &5
5&6	BJTs	Sedra/Smith &6
7&8	Small Signal Modelling	Sedra/Smith &7
9&10	Transistor Amplifiers	Sedra/Smith &7
11&12	Digital Logic	Sedra/Smith &14

Note that dates are approximate.

ASSESSMENT

Component	Weight
Review test	10%
Forum participation	4%
Design Project	15%
Lab Reports	10%
Two midterms 14% each	28%
Final Exam	33%
Total	100%

The instructor reserves the right to choose the format (i.e., written or oral) of any deferred midterm or final exam in this course.
Please note that announcements concerning any type of graded material may be in any format (e.g., announcements may be made only in class, via the course e-mailing list, or on the course web site). Students are responsible for completing the graded material regardless of whether they received the announcement or not.

ACCREDITATION LEARNING OUTCOMES

Note: The *Learning Outcomes* defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student's actual grade in the course. For more information on accreditation, please ask your instructor or visit: http://www.engineerscanada.ca .

Specify the iv-characteristics of diodes, MOSFETs, and BJTs graphically and analytically.
Identify device parameters from data sheets for diodes, MOSFETs, and BJTs.
Extract device parameters from iv-characteristics for diodes, MOSFETs, and BJTs.
Calculate DC or large signal currents & voltages in circuits containing diodes, MOSFETs, and BJTs.

Calculate static and dynamic properties of NMOS and CMOS logic gates.
Design complex CMOS gates, including proper transistor sizing.
Calculate small signal currents and voltages in circuits containing diodes, MOSFETs, and BJTs.
Represent the small signal behavior of amplifier circuits using two port models.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour 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 types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

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.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".http://www.mcmaster.ca/msaf/

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NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

Electrical and Computer Engineering Lab Safety

Information for Laboratory Safety and Important Contacts

This document is for users of ECE instructional laboratories in the Information Technology Building.

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.

Location of Safety Equipment

Fire Extinguisher
On walls in halls outside of labs

First Aid Kit
ITB A111, or dial “88” after 4:30 p.m.

Telephone
On the wall of every lab near the door

Fire Alarm Pulls
Near all building exit doors on all floors

Who to Contact

Emergency Medical / Security: On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.
Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.
University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.
See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs
Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.
ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:

1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask!

In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

Defined Roles

TA	The first point of contact for lab supervision	
ECE Lab Supervisor	Steve Spencer- ITB 147	steve@mail.ece.mcmaster.ca
ECE Chair	Tim Davidson- ITB A111	davidson@mcmaster.ca
ECE Administrator	Kerri Hastings- ITB A111	hastings@mcmaster.ca
ECE Course Instructor	Please contact your specific course instructor directly	