ENGG*3450 Electrical Devices
Fall 2013

School of Engineering

((Revision 0: September 5, 2013)

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1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: Arafat Al-Dweik, PhD
Office: RICH 2513, ext. 52153
Email: aaldweik@uoguelph.ca
Office hours: TBA on Courselink or by appointment

1.2 Lab Technician

Hong Ma
Office: THRN 1506, ext. 53873
Email: hongma@uoguelph.ca

1.3 Teaching Assistants

GTA	Email	Office Hours
Ahmed Elsamman	aelsamma@uoguelph.ca	TBA on Courselink
Ahmed Shaltout	ashaltou@uoguelph.ca	TBA on Courselink
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Ahmed Mahmood	amahmood@uoguelph.ca	TBA on Courselink

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2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*3450 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

R. Boylestad and L. Nashlesky, Electronic Devices and Circuit Theory, 11th edition, Prentice Hall.

http://catalogue.pearsoned.ca/educator/product/Electronic-Devices-and-Circuit-Theory/9780132622264.page

2.3 Recommended Resources

Thomas L. Floyd, Electronic Devices, 9th Edition, Prentice Hall.

2.4 Additional Resources

Lecture Information: All the lecture notes are posted on the web page (week 1- 12).

Lab Information: The handouts for all the lab sessions are within the lab section. All types of resources regarding tutorials, links to web pages can be found in this section.

Assignments: Course assessment will be based on exams, quizzes and lab reports.

Exams: Samples of previous exams might be distributed in class or posted at the course website.

Miscellaneous Information:

2.5 Communication & Email Policy:

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student.

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3 ASSESSMENT

3.1 Dates and Distribution

Quizzes: 10%

- Quiz 1: October 4th , in class
- Quiz 2: November 15th , in class

Labs: 30%

- Lab reports 15%, 5 sessions, see section 5.4 below for due dates
- Lab final exam 15% , Week 12 (18 to 22 November)

Midterm Test: 20%
Friday October 25th, 12:30-13:30, Room TBA on Courselink

Final Exam: 40%
Thursday Dec 13, 08:30-10:30, Room TBA on Webadvisor

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: In order to pass the course, you must pass both the laboratory and exam course portions. Students must obtain a grade of 50% or higher on the exam portion of the course in order for the laboratory write-up portion of the course to count towards the final grade.

Missed midterm tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late Lab Reports: Late submissions of lab reports will not be accepted.

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4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

Semiconductor materials, Silicon, Germanium and other semi-conductors' material, Doping and effects of extrinsic material introduction, conduction in metals and semi-conductors, electrical and thermal characteristics of diodes and transistors; principles of modern electronic devices and their applications in circuits; diodes; bipolar and field effect transistors; circuit integration; operational amplifiers; logic gates.

*Prerequisite(s): ENGG*2450*

4.2 Course Aims

This course aims at:

1. Providing the students with solid understanding of the physical and electrical properties of semiconductor materials and their use in microelectronic circuits.
2. Relate the atomic and physical properties of semiconductor materials to device and circuit performance issues. The
3. Develop an understanding of the connection between device-level and circuit-level performance of microelectronic systems

4.3 Learning Objectives

Students who successfully complete this course will be able to:

1. describe the basic principles of operation of semiconductor diodes and transistors and use their specifications in the design of circuits.
2. design basic electronic circuits using semiconductor devices such as diodes and transistors.
3. analyse and evaluate the performance of various electrical circuits that consists of diodes, transistors and operational amplifiers.
4. develop models of operational amplifiers for the design of signal processing circuits.
5. gain understanding of binary logic circuits to develop decision making systems.
6. become familiar with the operation and characteristics of some of the most commonly used Integrated Circuits units (ICs).

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2,3, 4	Quizzes, Exams
2. Problem Analysis	3	Quizzes, Exams
3. Investigation	3, 5	Labs
4. Design	2, 4	Quizzes, Exams
5. Use of Engineering Tools	3	Labs
6. Communication	1, 4	Labs
7. Individual and Teamwork	-	Labs
8. Professionalism	-	-
9. Impact of Engineering on Society and the Environment	6	Exams
10. Ethics and Equity	-	-
11. Environment, Society, Business, & Project Management	-	-
12. Life-Long Learning	6	-

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for exams and labs.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and tutorials. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

Previous Courses:

Electric Circuits (ENGG*2450): The ENGG*3450 course tackles the semiconductor devices and their applications. Hence, the student should have a solid foundation of RLC circuit analysis, ideal operational amplifiers, DC and AC circuit analyses. Also, the student should know the fundamental laws of electricity.

Follow-on Courses:

Embedded Reconfigurable Computing Systems (**ENGG*3050):** Analyses, synthesis and design of Embedded Reconfigurable Computing Systems

Introduction to Mechatronics System Design (ENGG*3490): Design of mechatronic systems with components from electronics and mechanical systems.

Analog Integrated Circuits (ENGG*4080): Describe the operating principles of analog integrated micro and nano electronic circuits.

Bio-instrumentation Design (ENGG*4390): Select components and design biological systems.

VLSI Digital Design (ENGG*4550): Analysis, synthesis and design of Very Large Scale Integration (VLSI) digital circuits.

5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures: Monday, Wednesday, Friday, 12:30 – 13:20, MAC 149

Tutorials:

Sec 01	Monday	15:30 – 16:30	RICH 1504A
Sec 02	Tuesday	11:30 – 12:30	RICH 1504A
Sec 03	Thursday	11:30 - 12:30	RICH 1504A

Laboratory:

Monday	Sec 01	15:30 – 17:30	RICH 1504A
Tuesday	Sec 02	11:30 – 13:30	RICH 1504A
Thursday	Sec 03	11:30 - 13:30	RICH 1504A

5.2 Lecture Schedule (Tentative)

Lectures	Lecture Topics	References	Learning Objectives
1	Course Overview	-	-
2 – 4	Review and introduction to Semiconductors	Chapter 1	1
5 – 7	Diodes and their applications	Chapter 2	2, 5
8 - 15	Bipolar Junction Transistors	Chapter 3, 4, 5	2, 3, 5
16 - 21	Field Effect Transistors	Chapter 6, 7, 8,9	2, 5
22 - 27	Operational Amplifiers	Chapter 10, 11	4
28 - 30	Linear Digital ICs	Chapter 13	3, 6
31 - 32	Oscillator Circuits	Chapter 14	3, 6
33 - 34	Power Supplies	Chapter 15	2, 3

5.3 Design Lab Schedule

Week **Activity** **References**

5.4 Lab and Tutorial Schedule

Week[1]		**Topic**
2	Lab 1	Voltage Divider Circuits
3	*Tut 1*	*Ch. 1,2*
4	Lab 2	Semiconductor Diodes
5	*Tut 2*	*Ch. 3, 4, 5*
6	Lab 3	Common Emitter Amplifiers
7	*Tut 3*	*Ch. 6, 7, 8, 9*
8	Lab 4	Field Effect Transistors
9	*Tut 4*	*Ch. 10, 11*
10	Lab 5	Operational Amplifiers
11	*Tut 5*	*Ch. 13, 14*
12	**------**	**Lab Final Exam**
13	*Tut 6*	*Ch. 15*

- **The report for each lab will consist of:**
  - Section 1: Introduction and Background (combined)
  - Section 2: the procedures used, measurements, results (also combined)
  - Section 3: discussion of results, errors/discrepancies and concluding

[1] Week 2 starts 9 September 2013

- ❖ Appendix: All data gathered during lab session.
- ❖ Report should not exceed 5 page plus a cover page.

- Lab experiments will be carried out by groups of **at least 2 and no more than 3 students**.
- Groups will form in the first week of labs and ***will not change*** during the course of the term.
- Each group must finish their experiments in the scheduled lab session.

5.5 Other Important Dates

Thursday, 5 September 2013: First class

Monday, 14 October 2013: Thanks giving holiday

Thursday, 31 October 2013: drop date – 40th class

Thursday, 28 November 2013: last class (Monday Schedule in effect)

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6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

Safety in the lab is a priority at all times. The labs are designed to be safe (the voltages are low), but be aware of the fact that misconnected devices may get extremely hot even to the point of bursting into flames! *Please always make sure that your connections are done correctly before turning the power on*.

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7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

Please also review the section on Academic Misconduct in your Engineering Program Guide.

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics

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8 ACCESSIBILITY:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible