

ENGPYHS 3BA3
Electronics I
Fall/Winter 2016/17
Course Outline

CALENDAR/COURSE DESCRIPTION

This course provides the theory as well as the practical introduction to semiconductor electronics including P-N junctions, diodes, bipolar junction transistors, field effect transistors, DC and AC modeling, differential and operational amplifiers, feedback and oscillators, digital circuits and multivibrators, signal processing.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): One of ENG PHYS 2A03, 2A04, 2E04, MEDPHYS 2B03, PHYSICS 2B06, 2BB3
Antirequisite(s): PHYSICS 3B06, PHYSICS 3BA3

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

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Office Hours:
By appointment

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Office Hours:
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COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

<http://avenue.mcmaster.ca/>

COURSE OBJECTIVES

Upon successful completion of the course, a student will:

- Be able to explain the basic properties of semi-conductors that are relevant for modern electronic devices.
- Be able to analyse electronic circuits with active components, both theoretically and experimentally.
- Be able to create electronic circuits with analog and digital components according to high-level requirements.
- Have communicated his/her work in written form.

MATERIALS AND FEES

Required Texts:

- "Electronics: A Physical Approach", David W. Snoke, Person Education Inc., 2015, ISBN 978-0-321-55133-7.

Other reference material:

- "Principles and Applications of Electrical Engineering", Giorgio Rizzoni, 5th Edition, McGraw-Hill, 2007, ISBN 978-0-07-296298-7
- "Electronic Devices and Circuit Theory", Boylestad, R. L. and Nashelsky L., any edition.

Calculator:

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

Other Materials:

- National Instrument's MultiSim, version higher than 10.0. (Included in Rizzoni's book, also available from studica.com);
- Lab equipment and consumables (provided).

COURSE OVERVIEW

Lectures

Date	Topic	Readings
Thu Sep 8	Course Outline and Review of Basics	Chs 1 and 2
Mon Sep 12	Review of Semiconductor Basics	Ch. 4.1 - 4.4
Thu Sep 15	Diodes	Ch. 4.5
Mon Sep 19	Diode Applications	Ch. 4.5
Thu Sep 22	Common Emitter Transistor	Ch. 5.1 - 5.3
Mon Sep 26	Common Emitter Transistor	Ch. 5.1 - 5.3
Thu Sep 29	Bias Stability (beta stability)	Lec. Notes and Rizzoni: 10.4
Mon Oct 3	Bias Stability (Voltage Divider Bias Circuit)	Lec. Notes, Rizzoni, example 10.9
Thu Oct 6	Multistage Amplifiers & Frequency Response	Lecture Notes
Mon Oct 10	Mid-term Break	
Mon Oct 17	Differential Amplifiers	Lecture Notes
Thu Oct 20	Op-amps	Ch. 6
Mon Oct 24	Op-amps	Ch. 6
Thu Oct 27	Op-amps	Ch. 6
Mon Oct 31	Oscillators	Ch. 6.5
Thu Nov 3	Multivibrators	Lecture Notes
Mon Nov 7	JFETS	Ch. 5.4.1, 5.4.4
Thu Nov 10	JFETS	Ch. 5.4.1, 5.4.4
Mon Nov 14	MOSFETs	Ch. 5.4.2
Thu Nov 17	MOSFETs	Ch. 5.4.2
Mon Nov 21	Review of Boolean Algebra	Ch. 7.1

Thu Nov 24	Digital logic circuits	Ch. 7.2
Mon Nov 28	Clocked digital logic circuits, timing diagrams	Ch. 7.3- 7.6
Thu Dec 1	Review	
Mon Dec 5	Review	

Labs

Date	Topic	Readings
Week 1	P-N Junctions I-V characteristics	Lab manual
Week 2	Rectification, power supplies, Zener regulation	Lab manual
Week 3 – 4	BJT common emitter amplifier	Lab manual
Week 5 – 6	Operational amplifier	Lab manual
Week 7	Introduction to digital electronics	Lab manual
Week 8 – 11	Design Project	Lab manual

ASSESSMENT

Component	Weight (%)	
Quizzes (online)	10	
Assignments	20	
Lab Reports	25	
Lab Notebooks	5	
Lab Exam	40	Must have > 50% to pass course
Total	100%	

ADDITIONAL DETAILS REGARDING COURSE MANAGEMENT AND ASSESSMENT

- Class attendance is not mandatory, but encouraged. There is a clear correlation between class attendance and performance in the course;
- Attendance at the weekly lab sessions is mandatory;
- Lab reports are required for: the first lab, one other lab of choice, the final design project. (3 reports total);
- Labs are performed in groups of two, reports are individual;
- Assignments and lab reports are marked individually.
- Late submissions of lab reports and assignments incur a penalty of 10% per day;
- All work is to be submitted through ATL. All work must be prepared with a word processor; scanned or photographed hand-written work is not accepted. However, diagrams and/or drawings may be hand-drawn (neatly) and pasted into the report.
- The final lab exam takes place for 90 minutes during the last lab:
 - Individually complete a randomly assigned lab task based on the labs you did during the term (see the lab exam sample tasks document on ATL).
 - Answer TA follow-up questions.

- No notes or resources allowed other than writing material and the McMaster Standard Calculator
- If you fail, you can retake the lab exam one week later. The maximum mark you can obtain in this case is 50% (for this exam)

ACCREDITATION LEARNING OUTCOMES

The Learning Outcomes defined in this section are measured for Accreditation purposes only, and will not be directly taken into consideration in determining a student's actual grade in the course.

Outcomes	Indicators
Apply the superposition principle and series expansion as it applies to linear networks, and Explain the concept of transformation from the time-domain to the frequency domain.	1.1
Summarize the concept of semiconductors in terms of doping, minority-and majority carriers, potential distribution, depletion layer, and explain the physics behind semiconductor devices such as diodes and transistors	1.2, 1.3
Analyze circuits with several semi-conductor components, such as diodes, transistors, field-effect transistors, operational amplifiers and logic circuits, including a proper analysis of errors and uncertainties.	2.1, 2.2,2.3
Apply informed decisions regarding approximations and assumptions in the analysis and design of circuits.	3.2
Design and optimize circuits including analog and digital components according to high-level requirements.	4.1, 4.3
Use a simulation tool (MultiSim) to analyse and design circuits; Use the laboratory tools relevant for electronics, such as oscilloscopes, volt- and amp meters and function generators.	5.2
Work in a small team in the design and prototyping of a circuit.	6.1
Compose proper reports on the experiments with electronic circuits.	7.3

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

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

1. The [McMaster Student Absence Form](#) is a self-reporting tool for Undergraduate Students to report absences DUE TO MINOR MEDICAL SITUATIONS that last up to 3 days and provides the ability to request accommodation for any missed academic work. Please note this tool cannot be used during any final examination period.
2. You may submit a maximum of 1 Academic Work Missed request per term. It is YOUR responsibility to follow up with your Instructor immediately (NORMALLY WITHIN TWO WORKING DAYS) regarding the nature of the accommodation. Relief for missed academic work is not guaranteed.
3. If you are absent for reasons other than medical reasons, for more than 3 days, or exceed 1 request per term you MUST visit the Associate Dean's Office (JHE/A214). You may be required to provide supporting documentation.
4. This form must be submitted during the period of absence or the following day, and is only valid for academic work missed during this period of absence.
5. It is the prerogative of the instructor of the course to determine the appropriate relief for missed term work in his/her course.
6. You should expect to have academic commitments Monday through Saturday but not on Sunday or statutory holidays. If you require an accommodation to meet a religious obligation or to celebrate an important religious holiday, you may submit the Academic Accommodation for Religious, Indigenous and Spiritual Observances (RISO) Form to the Associate Dean's Office. You can find all paperwork needed here: <http://www.eng.mcmaster.ca/current/documents.html>

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.

TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/>.

ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using e-mail and Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to <http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf>.