

## ENGR-345: Electronics 1

Fall Semester 2009, 4 credits

**Instructor:** Dr. Ramesh Rajagopalan

**Lab Instructor:** Jared Sieling. Contact via email: siel0042@umn.edu

### Contact

**Information:** Office: OSS – 104  
Office phone: 651-962-5414  
E-mail: ramesh@stthomas.edu

**Class time:** Lecture: M, W, F – 1:35 pm to 2:40 pm

**Room:** Owens Science Hall LL54

**Office Hours:** By Appointment

**Required Text:** “Microelectronics, Circuit Analysis and Design”, 3rd Ed. By Donald Neamen, McGraw-Hill

**Course Description:** Analysis of electronic devices and circuits. Topics include linear and non-linear models of devices, feedback and circuit design techniques. Applications include amplifiers, demodulation, oscillators, logic implementation.

**Prerequisites:** ENGR-240 and PHYS-225

**Learning goals:** Understanding of the fundamentals of operation, analysis and design of electronic devices and circuits as demonstrated in exams, homework, and laboratory experiments.

Ability to apply the principles noted above to the design and analysis of practical circuits.

**Learning Outcomes:** Upon successful completion of the course, as measured by graded performance, the student will be able to:

### Skills:

- Use of standard analog laboratory test equipment for building, trouble shooting and assessing performance of circuits. (b)
- Ability to analyze and design standard analog circuit topologies such as discrete amplifiers, passive and active filters, rectifiers, doublers, and op-amp circuits for low and high frequency applications. (c)
- Ability to create and apply linear and non-linear models of electronics devices. (a)
- Ability to design and analyze for the desired and actual frequency characteristics of a circuit. (c)
- Ability to develop, use, and apply Bode plots for characterizing the frequency response

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of electronic devices and circuits. (a)

- Understand and apply the op-amp as a building block for a multitude of applications (a, e)

- Knowledge:
- Understand the basic operation of semiconductor devices: Diodes, BJTs, and FETs. (a)
  - Understand diode, BJT, and FET electrical performance characteristics at low and high frequency. (a)
  - Understand and apply the characteristics of non-linear diode circuits. (a, e)
  - Understand the I/O properties of standard single-ended and differential amplifier topologies for signal and power applications. (a, k)
  - Understand the principles underlying the frequency analysis of devices and circuits along with the methods of representing and applying these principles. (a, k)
  - Understand and apply the op-amp as a building block for a multitude of applications. (a, e)
  - Understand the typical specifications in electronic component and device data sheets. (a)

- Attitudes:
- Exhibit concern for the safety of themselves and others (b)
  - Exhibit efficient use of time and resources, (f)
  - Exhibit courtesy to classmates, faculty and staff, (f)
  - Exhibit personal integrity, (f)
  - Exhibit desire for clear communication, (g)
  - Exhibit desire to achieve. (i)

### Course methodology

This class will use blackboard. Lectures, assignments, and course announcements will be posted on blackboard. Please check blackboard at least once a day for class communications.

### Course objectives

- Gaining factual knowledge (terminology, classification, methods, trends)
- Learning fundamental principles, generalizations, and theories
- Learning to apply course material (to improve thinking, problem solving, and decisions)
- Developing skills, competencies, and points of view needed by professionals in the field most closely related to this course

### Exam dates:

Exam 1: 9/30

Midterm: 10/28

Exam2: 11/18

Final exam: 12/16; 10:30 am -12:30 pm

### Makeup policy

There will be no make up for assignments. For exams, **make up may be granted only for a medical emergency**. The student should inform the instructor well in advance and provide appropriate

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documentation from a physician. There are no exceptions to this policy. **Make up exams will not be granted for any other scenarios such as scheduled interviews or business trips.**

**Schedule: Tentative and subject to change**

Date	Topic	Chapter	Exams
09/09	Semiconductor devices	1	
09/11	Semiconductor devices	1	
09/14	Diode circuits	2	
09/16	Diode circuits	2	
09/18	Diode circuits	2	
09/21	FET	3	
09/23	FET	3	
09/25	FET	3	
09/28	FET	3	
09/30			<b>Exam1</b>
10/2	FET amplifiers	4	
10/5	FET amplifiers	4	
10/7	FET amplifiers	4	
10/9	FET amplifiers	4	
10/12	FET amplifiers	4	
10/14	BJT	5	
10/16	BJT	5	
10/19	BJT	5	
10/21	BJT	5	
10/23	BJT amplifiers	6	
10/26	BJT amplifiers	6	
10/28			<b>Midterm</b>
10/31	<b>Midterm break</b>		
11/2	BJT amplifiers	6	
11/4	BJT amplifiers	6	
11/6	BJT amplifiers	6	
11/9	Frequency response	7	
11/11	Frequency response	7	
11/13	Frequency response	7	
11/16	Frequency response	7	<b>Exam2</b>
11/18			
11/20	Power amplifiers	8	
11/23	Power amplifiers	8	
11/25	Power amplifiers	8	
11/26	<b>Thanksgiving break</b>		
11/30	Operational amplifiers	9	
12/2	Operational amplifiers	9	
12/4	Operational amplifiers	9	
12/7	Special topic	Noise	
12/9	Special topic	Noise	
12/11	Review		

**Grading policy:**

1. The final grade will be based on:  
Assignments - 10%  
Exam1 - 15%  
Midterm exam - 25%  
Exam2 - 15%  
Final exam - 35 %
2. **The entire course will be graded on a curve.** Hence your final course grade is determined based on the final distribution of all grades in the class, not on any specific grade cut-off. When grading on a curve, the absolute score is not that important. **Don't be upset if you don't get what you consider to be a high score.** To give you a feeling about where you stand, statistics about the scores will be provided periodically. I assign the final grades using the following guidelines. We utilize a plus/minus grading system.

A	Achievement that is outstanding and well above the level necessary to meet course objectives
B	Achievement that is above the level necessary to meet course objectives
C	Achievement that meets the basic course objectives
D	Achievement that is worthy of credit even though it does not fully meet the course objectives
F	Achievement that fails to satisfy the basic course objectives

**Academic Integrity:** All students are expected to understand and follow University of St. Thomas policies on Academic Integrity. These are described at: [http://www.stthomas.edu/policies/student\\_policy\\_book/Academic\\_rights\\_and\\_procedures.htm](http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.htm)

**Attendance:** Students are encouraged to attend all class sessions. If you cannot attend a lecture or two, it's fine. If a special situation arises and you need to miss more than two lectures, contact me.

**Disability accommodation:** Qualified students with documented disabilities who may need classroom accommodations should make an appointment as soon as possible with the Enhancement Program – Disability Services office. Appointments can be made by calling 651-962-6315. You may also make an appointment in person in O'Shaughnessy Educational Center, room 119. For further information, you can locate the Enhancement Program on the web at <http://www.stthomas.edu/enhancementprog/>

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## Lab Schedule

Date (Lab sections)	Lab	Topic
15 Sep	Lab 0	Intro/Diode
22 Sep	Lab 1	More Diode
29 Sep	Lab 2	MOSFET
6 Oct	Lab 3 (Formal Lab write up)	FET Amplifier
13 Oct	Lab 4	Understanding Impedance
20 Oct	Lab 5	BJT
27 Oct	Lab 6	Basic Current Sources
3 Nov	Lab 7	BJT Amplifier
10 Nov	Lab 8	CMOS Logic
17 Nov	Lab 9 (Formal Lab write up)	Frequency Response
24 Nov	Lab 10	Power Amplifier
1 Dec	Lab 11	Circuit Building Practice
8 Dec	Lab Final	

**Lab Contact** Jared Sieling. Contact via email: [siel0042@umn.edu](mailto:siel0042@umn.edu)

**Lab time (two sections)** Tuesday 8:30-11:35 and 13:30-17:00  
OSS LL09

**Lab Information** Labs will be posted the Friday before the lab meets. Expectation is that you print out the upcoming Lab, read through it, refer to textbook or class notes to help you understand the lab, discuss things with your lab partner (or others in the class) and come prepared to do the lab.

### Lab

**Objectives**

- Learning to apply course material (to improve thinking, problem solving, and decisions)
- Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course
- Learning how to find and use resources for answering questions or solving problems
- Acquiring skills in working with others as a member of a team

**Pre-Labs** At the beginning of each lab period, a Pre-Lab worksheet will be completed by each student. An example of the week's Pre-Lab will be posted with each Lab.

**Lab Partners** Labs will be done in partners, with each partner completing their own notebook. You must choose a partner for Labs 0-5 by the start of Lab 0. You will change partners for Labs 6-11.

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### **Lab**

**Notebooks** Each student must have two bound lab notebooks. The notebook containing the previous week's lab will be turned in at the beginning of the Lab session for grading (Lab 2 will be turned in at the beginning of Lab 3 session), and the second notebook will be used for that Lab.

### **Formal**

**Lab Reports** Labs 3 & 9 will require a formal lab report using the following format.

- 1) Introduction containing the lab objectives, explanation of appropriate EE and physics background material, and any additional information needed for an introduction.
- 2) Experimental setup description and appropriate discussion.
- 3) Explanation of experimental results & comparison of expected theory and experimental data. Discussion of possible sources of error which lead to deviation of experimental data from theoretically expected results. Discussion of any graphs, tables, and so forth necessary to explain data.
- 4) Conclusion summary and possible applications.
- 5) Appendix which incorporates experimental raw data sheet and data.

### **Lab**

**Attendance** Due to the spread of the H1N1 flu virus, the attendance and late submission policy will be decided on a case by case basis. It is important that if you experience any symptoms of the flu, to isolate yourself for 24 hours. If you experience flu symptoms or need to miss a lab for any other reason, or cannot submit a due assignment on time, contact the instructor by email prior to the lab session, and a make-up schedule can be discussed.

**Lab Final** The last lab session will contain an individual, comprehensive, hands-on lab final. The final will cover all topics of the previously completed Labs and include circuit building, analysis, and design.

**Lab Grades** Lab Grades will be based on the following rubric:

- 50% - Lab notebooks and Pre-Labs
- 30% - Two formal lab write-ups
- 20% - Lab Final

**2009 - 2010 Syllabus Statement Related to Influenza:**

The University of St. Thomas is committed to a healthy campus community. During the 2009-2010 academic year, there will be ongoing concerns regarding the prevalence among university faculty, staff and students of both the H1N1 virus and seasonal influenza. To help limit the spread of these illnesses, the Centers for Disease Control has provided college campuses the following recommendation: students, faculty, or staff with influenza like illnesses (temperature of 100.0 or greater, plus a cough or sore throat) are directed to self-isolate (or stay home) for at least 24 hours after their fever is gone without the use of fever-reducing medicine. In the event that students are unable to attend classes due to this self-isolation recommendation, they should consult the university's pandemic web site <http://www.stthomas.edu/pandemic/plan/default.html> and complete an on-line form informing professors of their absence. In accordance, faculty will provide opportunities for these students to participate in alternative educational delivery due to this illness.