ELC 383 (1.0 CU)  
Electronics II

Course Information:  
Spring 2016:  
TF 10:30 AM – 12:20 PM/AR144 (Lecture)

Course Description:  The continuation of ELC 251 covering the analysis and design of electronic circuits and systems: small-signal analysis, cascode amplifiers, active biasing, current mirrors, frequency response, power amplifiers, CMOS digital logic gates, active filters, switched capacitors, non-linear op-amp applications, and oscillators.

Professor: Larry Pearlstein

Instructor Information:  
Office Location: AR 130B  
Phone: (267) 566-5699  
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Office Hours:  
Wednesdays 2:00 PM – 3:20 PM  
Thursdays 2:00 PM – 3:20 PM  
By appointment (send me email)  
And whenever my office door is open

Textbook:  
ISBN 978-0199339136

Prerequisite:  
Electronics I (ELC 251)

Grading Policy:  
Homework 5% (no credit for late homework)  
Design assignments 20%  
Quiz 1 20%  
Quiz 2 20%  
Final Exam 35%

Tips for Success:  
Read the book sections prior to their discussion in class.  
Do as much homework as possible.  
Do not be shy about asking questions, either during class or outside of the class.

College Level Policies:  
Attendance Policy: [http://www.tcnj.edu/~recreg/policies/attendance.html](http://www.tcnj.edu/~recreg/policies/attendance.html)  
Academic Integrity Policy: [http://www.tcnj.edu/~academic/policy/integrity.html](http://www.tcnj.edu/~academic/policy/integrity.html)  
Americans with Disabilities Act (ADA) Policy: [http://www.tcnj.edu/~affirm/ada.html](http://www.tcnj.edu/~affirm/ada.html)
### Tentative Agenda:

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<td><strong>Week of 1/25</strong></td>
<td>Review of MOSFETs and BJTs</td>
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<td><strong>Design Assignment 2</strong> – Biasing NPN and NMOS</td>
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<td>2</td>
<td><strong>Week of 2/1</strong></td>
<td>Sections 7.1, 7.2, 7.3, 7.4</td>
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<td>Small signal models and biasing</td>
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<td><strong>Week of 2/15</strong></td>
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<td>Current sources, mirrors, steering</td>
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<td>Section 8.3</td>
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<td>Basic gain cell</td>
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<td>6</td>
<td><strong>Week of 2/29</strong></td>
<td><strong>Design Assignment 2</strong> – Biasing NPN and NMOS</td>
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<td><strong>Review</strong></td>
<td><strong>Design Assignment 3</strong> – MOSFET and BJT Amp</td>
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<td><strong>Week of 3/7</strong></td>
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<td>Sections 9.1, 9.2, 9.5</td>
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<td>Diff Amps</td>
<td><strong>Design Assignment 6</strong> – Active Filter</td>
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<td><strong>Week of 3/14</strong></td>
<td><strong>Design Assignment 5</strong> – Interfacing to MCU</td>
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<td>BREAK!!</td>
<td><strong>Design Assignment 6</strong> – Active Filter</td>
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<td><strong>Week of 3/21</strong></td>
<td><strong>Design Assignment 5</strong> – Interfacing to MCU</td>
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<td>Switching circuits, and interfacing to microcontrollers</td>
<td><strong>Design Assignment 6</strong> – Active Filter</td>
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<td>10</td>
<td><strong>Week of 3/28</strong></td>
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<td>CMOS Logic</td>
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<td>Week</td>
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| 13 Week of 4/18 | Switched Capacitor Filters        | Sections 17.3-17.4  
|              |                                    | LC and crystal oscillators  
|              |                                    | Multivibrators                 |
| 14 Week of 4/25 | Waveform generation  
|              | 555 timer                          | **Design Assignment 7 – 555 timer**            |
| 15 Week of 5/2  | Nonlinear waveform-shaping  
|              | Precision rectifiers                | Review                                  |
Educational Objectives
(What TCNJ ECE engineers should be able to accomplish during the first few years after graduation)

- To contribute to the economic development of New Jersey and the nation through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in industry or public service through engineering ability;
- To maintain career skills through life-long learning.

Electrical and Computer Engineering Student Outcomes
(What TCNJ Electrical and Computer Engineering students are expected to know and be able to do at graduation. What knowledge, abilities, tools and skills the program gives the graduates to enable them to accomplish the Educational Objectives)

The Student Outcomes listed below are expected of all graduates of the Electrical or Computer Engineering Program.

ECE graduates will have:

a. an ability to apply knowledge of mathematics, science and engineering;
   Math used extensively in homework problems and exams.

b. an ability to design and conduct experiments, as well as to analyze and interpret data.

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
   Students do design in homework problems.

d. an ability to function in multidisciplinary teams;

e. an ability to identify, formulate and solve engineering problems;
   Students do homework problems.

f. an understanding of professional and ethical responsibility;

g. an ability to communicate effectively;

h. the broad education necessary to understand the impact of engineering solutions in a global and societal context;

i. a recognition of the need for and an ability to engage in life-long learning;

j. a knowledge of contemporary issues;

k. an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;
   p-Spice tools are discussed throughout the course.
**Course Objectives**:  

Objective 1: To analyze and design IC amplifier stages using bipolar-junction transistor (BJT) and field-effect transistor (FET) technologies. [a, c, e, k]  
Objective 2: To analyze the frequency response of transistor amplifiers. [a, e]  
Objective 3: To analyze linear and non-linear op-amp circuits. [a, e, k]  
Objective 4: To design digital logic gates using CMOS technology. [a, e, k]  

**Topics Covered**:  
1. Transistor amplifier design  
2. Current sources and current mirrors  
3. Analysis of the basic gain cell  
4. Cascode amplifiers  
5. Differential amplifiers  
6. Frequency response of transistor amplifiers  
7. Switching circuits and CMOS digital logic  
8. Active filters  
9. Switched capacitors  
10. Multivibrator oscillators  
11. Non-linear op-amp circuits  

**Evaluation**:  
A. Quiz 1  
B. Quiz 2  
C. Final Examination  
D. Design assignments  

**Performance Criteria**:  

Objective 1:  
Student will be able to design and analyze MOS and BJT IC amplifier stages. (A, D)  

Objective 2:  
Student will be able to analyze the frequency response of transistor amplifiers. (B)  

Objective 3:  
Student will be able to analyze linear and non-linear op-amp circuits. (C, D)  

Objective 4:  
Student will be able to design digital logic gates using CMOS technology. (B)  

* Small letters in brackets refer to the Student Outcomes  
** Capital letters in brackets refer to the evaluation methods used to assess student performance
ELC 383: ADDITIONAL INFORMATION

1. DESCRIPTION OF DESIGN ACTIVITY

Students will design, analyze, simulate and evaluate linear circuits.

2. ENGINEERING STANDARDS

N/A.

3. REALISTIC CONSTRAINTS

**Economic:** The cost reduction impact of linear and digital Very Large Scale Integration (VLSI) semiconductor circuits is covered in this course.

**Environmental:** Techniques for lower power design are examined, that require less energy usage.

**Sustainability:** N/A.

**Ethical:** N/A.

**Social Impact:** N/A.

4. MODERN AND PROFESSIONAL ENGINEERING TOOLS USAGE

PSpice is used extensively throughout the course.

5. COMPUTER USAGE

Students use computers for circuit simulation.

6. FEEDBACK MECHANISMS

**Examinations:** Students are given two midterm and one final examinations.

**Reports:** N/A.

**Homework:** Homework problems are assigned and graded. These problems are a mixture of analysis and design problems.