ELC 383 (1.0 CU)
Electronics II

Course Information **Professor: Larry Pearlstein**

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.

Instructor Information:
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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: *Microelectronic Circuits*, 7th Edition by Adel S. Sedra and Kenneth C. Smith, Oxford University Press, 2014. NOTE: you can also use the 6th Edition.
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

Academic Integrity Policy: http://www.tcnj.edu/~academic/policy/integrity.html

Americans with Disabilities Act (ADA) Policy: http://www.tcnj.edu/~affirm/ada.html

Tentative Agenda:

Week	Tuesday Class	Friday Class
1 Week of 1/25	Sections 7.1, 7.2 Small-signal models	Sections 7.3, 7.4 Basic configurations, biasing
2 Week of 2/1	**Design Assignment 1** – Biasing BJT – pnp and npn	**Design Assignment 1** – Biasing PMOS and NMOS
3 Week of 2/8	Section 7.5 Amplifiers	**Design Assignment 2** – BJT Amp
4 Week of 2/15	**Design Assignment 2** – MOSFET Amp	Sections 8.1, 8.2 Current sources, mirrors, steering
5 Week of 2/22	Section 8.3 Basic gain cell	Sections 8.4-8.6 Cascode
6 Week of 2/29	**Review**	**Quiz 1 (Chapters 7 & 8)**
7 Week of 3/7	Sections 9.1, 9.2, 9.5 Diff Amps	Section 10.1 Low frequency response
8 Week of 3/14	**BREAK!!**	**BREAK!!**
9 Week of 3/21	Switching circuits, and interfacing to microcontrollers	**Design Assignment 3** – Interfacing to MCU
10 Week of 3/28	CMOS Logic Sections 14.1, 14.2	**Review**
11 Week of 4/4	**Quiz 2**	Active filters
12 Week of 4/11	Active filters	Switched Capacitor Filters
13 Week of 4/18	**Design Assignment 4 –** Active Filter	(Sections 17.3-17.4) LC and crystal oscillators Multivibrators
14 Week of 4/25	Waveform generation 555 timer	**Design Assignment 5** – 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)

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* 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.