C A M O S U N C O L L E G E
ELECTRONICS & COMPUTER ENGINEERING DEPARTMENT
COURSE OUTLINE ELEN 147

Objectives:

The objective of this course is to provide the student with both a theoretical and practical foundation in the analysis, design and implementation of linear and non-linear circuits. This course is a continuation of ELEN 144.

ELEN 147 Semiconductor Devices (II)

CREDITS:	3
IN-CLASS WORKLOAD:	3 hours lecture, 2 hours lab
OUT-OF-CLASS WORKLOAD:	5 hours
PREREQUISITES:	C in ELEN 142, C in ELEN 144.

Reserved for DND students

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Lab Instructor: Dr. Osman Goni
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Intended Learning Outcomes

Upon successful completion of this course, the student will be able to:

Explain the operation of fundamental transistor amplifier circuits

Calculate component values for operational amplifier circuits such as:

Inverting and Non inverting amplifier

Summing amplifier

Integrating and differentiating applications

Instrumentation and active filters circuits

Explain the operation of three terminal regulators

Explain fundamental data acquisition concepts such as:

Quantization concepts

Digital-to-analog converters (D/A)

Analog-to-digital converters (A/D)
Frequency-to-voltage converters (F/V)
Voltage-to-frequency converters (V/F)

OUTLINE OF TOPICS:

1. Operational Amplifier Overview
a. differential inputs
b. open Loop Gain, Impedance

2. Basic Op amp Circuit Analysis
a. negative feedback, virtual ground
b. closed loop gain
c. inverting amplifier
d. non inverting amplifier
e. voltage follower, current amplifier
f. summing amplifier
g. input and output impedance of basic circuits
h. saturation voltage
i. single supply OpAmp
j. BJT current boost

3. Integrating and Differentiating amplifiers
a. integrator circuit and voltage calculations
b. estimate output waveforms for various inputs
c. differentiator circuit and voltage calculations
d. estimate output waveforms for various inputs

4. Differential Amplifiers
a. differential and common mode voltages
b. common mode rejection ratio
c. Amplifier instrumentation amplifier

5. OpAmp Diode Circuits.
a. precision diode
b. DC restorer-clamper
c. voltage limiter-clipper

6. Voltage regulation and Current Limit
a. voltage regulation
b. line regulation
c. OpAmp voltage regulator
d. current limit
e. voltage regulator IC

7. Power Amplifier
a. Types
b. IC Amplifier

8. Active Filters
Introduction to filter types;
a. low pass, high pass, band pass and band reject
b. Sallen Key filter circuit
c. Filter Bode Plot
i. passband
ii. cutoff frequency
iii. roll off
iv. decibels per decade
v. 1^{st} order and 2^{nd} order
d. bandpass filter characteristics

9. Comparators
a. zero level detector
b. non zero detector
c. Schmitt trigger
d. 555 timer circuit

10. Windows Comparator and 555 Timer
11. Signal Conversion
a. quantization concepts
b. analog-to-digital converters (ADC)
c. digital-to-analog converters (DAC)
d. frequency-to-voltage converters (FVC)
e. voltage-to-frequency converters (VFC)
f. Applications

Lab exercises: (might change due to online teaching)

1. Introduction to operational amplifiers
2. Op-Amp single supply operation and current boost
3. Op-Amp integrator and differentiator circuits
4. Instrumentation amplifier
5. Ideal diode circuit, dc restorer circuit and current limiter circuit
6. Linear voltage regulator
7. Mid-Term (no formal lab)
8. Active filters
9. Window Comparator
10. Oscillator circuits (555 Timer)
11. Analog to digital converter
12. Mid-Term (no formal lab)
13. Digital to analog converter
14. Frequency to voltage converter

EVALUATION
Students must obtain a minimum of 60% in both the theory and practical portions of the course
and a minimum of 50% on the final exam.
Laboratory marks will be based on the completeness of each lab exercise and an instructor evaluation of the student's work.

Final Grade Composition

Assignments	10%	
Quizzes	10%	
Mid-term I		15%
Mid-term II		15%
Final Exam		40%
Total theory	90%	
Laboratory Evaluation		10%
Total		100%

Grading (in accordance with College policy):

A+ 90 – 100%	B- 70 - 72%
A 85 – 89%	C+ 65 - 69%
A- 80 – 84%	C 60 - 64%
B+ 77 – 79%	D 50 - 59%
B 73 – 76%	F < 50%

TEXTS AND REFERENCES

- Information and documents available on the course D2L site
- Electronic Devices, T. L. FLOYD 7th edition ISBN 0-13-127827-4.
- Laboratory Exercises to be provided in class.