C A M O S U N C O L L E G E

ELECTRONICS & COMPUTER ENGINEERING DEPARTMENT

COURSE OUTLINE ELEN 147

CALENDAR DESCRIPTION

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: Gurbinder Dhade

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. 1st order and 2nd 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:

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. **Mid-Term (no formal lab)**
7. Linear voltage regulator
8. Active filters
9. Window Comparator
10. Oscillator circuits (555 Timer)
11. **Mid-Term (no formal lab)**
12. Analog to digital converter
13. Digital to analog converter
14. Frequency to voltage converter

Holidays

- May 20 - Victoria Day - College closed (Week 3)
- July 1 - College Closed, Closure, Holiday (Week 9)
- August 5 - British Columbia Day, College closed (Week 14)

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 habits and attitude.

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 5th edition ISBN 0-13-649138-3.
- Laboratory Exercises to be provided in class.