

**TEXAS A&M UNIVERSITY**  
**ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT**

**ECEN 458 SYLLABUS**  
**ACTIVE FILTER ANALYSIS AND DESIGN**

<b>Instructor:</b>	Edgar Sánchez-Sinencio	<b>Fall 2009</b>
<b>Office:</b>	318E WERC	<b>Time:</b> TR 11:10-12:25
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<b>Office Hours:</b>	Tues, Thu, 2:00 to 3:00 PM	

**Textbook:** *Design of Analog Filters*, R. Schaumann and M.E. Van Valkenburg, Oxford University Press, 2001.

### References

- [1] *Analog Integrated Circuit Design*, David A. Johns, and Ken Martin, John Wiley & Sons, Inc., New York, 1997. Chapters 10 & 15
- [2] *Design with Operational Amplifiers and Analog Integrated Circuits*, S. Franco, McGraw Hill, New York, 1988
- [3] *Analog Filter Design*, M. E. van Valkenburg, Holt, Rinehart and Winston, Inc. (Saunders College Publishing), 1982
- [4] *Design of Analog Filters Passive, Active RC, and Switched Capacitor*, R. Schaumann, M. S. Ghauri, and K. R. Laker, Prentice Hall, New Jersey, 1990

**OBJECTIVES:** To analyze and design active-filters. Emphasize the design of practical filters for a host of applications. To blend theory and practice. This is a hands-on course. The final project ends in a prototype.

### Learning Outcomes

At the end of the course the student will be able to:

- 1) Conduct system level design and simulation of active filters based on basic block diagrams.
- 2) Estimate frequency and time response at the system level of analog filters.
- 3) Understand how to map a basic blocks diagram into a circuit implementation based on Op Amp or Transconductance Amplifier.
- 4) Synthesize into a mathematical expression the filter frequency response specifications.
- 5) Understand the practical design trade-offs of Continuous-Time and Discrete-Time (Switched-Capacitor) filters.

### Grading Policy

Partial Exam 1	20%
Partial Exam 2	15%
Partial Exam 3	15%
Laboratory	20%
Homework	25%
Quizzes	<u>5%</u>
	100%

## **Special Notes**

- 1) No final exam will be given. Partial accumulative exams can be take-home or closed book (with only one page information possibly). Exams can be scheduled to be out of class.
- 2) There will be no make-up exams for individual cases, unless it is properly justified, e.g. medical or family emergency.
- 3) Quizzes will be given randomly.
- 4) Homework is due at the beginning of the class on the due date. Late homework is not accepted.
- 5) Knowledge of using SPICE (CADENCE), SIMULINK and FIESTA II is strongly suggested.

## **Laboratory (Tentative Topics)**

1. Op Amp
2. OTA Characterization
3. Design of a Crossover Filter
4. Elliptic BP Filter
5. Design of a BP-based Oscillator
6. Graphic Equalizer Filter
7. Design, Implementation and Simulation of Switched Capacitor
8. Switched Capacitor Filter

## **Contributions to Professional Component:**

1. Prepares students to solve the analog signal filtering basic problem.
2. Prepares students to understand and evaluate modern literature of filter design and filter applications.
3. Instills within the student an appreciation of linking theory and practice through circuit simulations and hands on laboratory experiments.

## **Americans with Disabilities Act (ADA) Policy Statement**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637. <http://disability.tamu.edu>

## **Academic Integrity Statement**

“An Aggie does not lie, cheat, or steal or tolerate those who do.”

Honor Council Rules and Procedures are on the web <http://www.tamu.edu/aggiehonor>

### TENTATIVE COURSE SCHEDULE

Week	Week of	Topic	Chapter	Lab	Remarks
1	Sept. 1-3	Introduction			Historical Review
2	Sept. 8-10	Basic Block and Systems	1 [3]		Key Blocks
3	Sept. 15-17	Systems Fundamentals	3,4 [2]		Good Fundamentals
4	Sept. 22-24	Approximation	6		Find its Origin and where to access software related
5	Sept. 29-Oct. 1	Biquad Circuits	6		Study input signal injections
6	Oct. 6-8	RC-Active Filters	2,5,6		Exam 1
7	Oct. 13-15	RC-Active Filters	2,3,5,6		Summarize Design Approaches and Topologies
8	Oct. 20-22	RC-Oscillators	2,5,6, Notes		Project Assignment
9	Oct. 27-29	OTA-C Filters	Notes		Study Commercial OTA's
10	Nov. 3-5	OTA-C Filters			Exam 2
11	Nov. 10-12	OTA-Oscillators	Notes		
12	Nov. 17-19	Switched Capacitor Filters	7, 17 [1]		
13	Nov. 24-26*	Switched Capacitor Filters Basics	7, 17 [1]		Find Commercial SC Filters
14	Dec. 1-3	Switched Capacitor Oscillators			Exam 3
15	Dec. 8**	Summary			Last day Dec. 8

\*Thanksgiving Holiday is Nov. 26 and 27.

\*\* Last Day of Classes is Dec. 8.