

GEORGIA INSTITUTE OF TECHNOLOGY  
School of Electrical and Computer Engineering

ECE 4410

Study Guide for Additional Material

December 6, 2006

General Information

- (a) The examination will be closed book and notes.
- (b) The exam **will be comprehensive** covering all material presented in the course. Only those topics covered in class, covered in the homework assignments, or listed in the several guides will be on the examination.
- (c) Topics on the final exam will be covered in proportion to the amount of time spent on each topic during the semester. The last material **will not** be emphasized.
- (d) This study guide covers only Chapters 12, 13, and 14. Consult previous study guides for a review of earlier material. Be sure to review the contents of all previous quizzes.
- (e) You should be able to work all homework problems, practice problems, and example problems. However, problems that require extensive algebra or arithmetic will not be given.
- (f) All answers must be circled, underlined or otherwise indicated. Give numerical answers as a decimal number to four significant figures. Give units with all answers. Be sure to indicate if work is continued on another page. No credit will be given for unsupported answers.
- (g) Lap-top or palm-top computers **MAY NOT** be used on the quiz. Likewise, calculators may not be used in "solve" mode. You must show all steps in your calculations.
- (h) This document is thought to be reasonably complete. However, some minor topics of interest may have been inadvertently omitted. However, you remain responsible for all material covered in class and in the several assignments.

## Chapter 12: OP-AMP Simulation of Passive Filters

Sections Covered: Entire Chapter.

What you should know:

- (a) Understand the ABCD matrix description of two-port networks. Be able to determine the ABCD matrices of simple circuits. Know the ABCD matrices of the positive and negative impedance converters.
- (b) Understand the circuit of the GIC given in Fig. 12.3. Know how the Equations (12.8) and (12.9) relate to the GIC.
- (c) Know how to use GICs to simulate grounded and floating inductors. Be able to simulate ladder networks using the GICs.
- (d) Understand the frequency-dependent negative resistance (FDNR) and be able to use it to simulate ladder networks.
- (e) Understand the leap-frog method of network realization. Given a simple ladder network, be able to deduce the leap-frog network equations. See Section 12.5.1.

## Chapter 13: Switched-Capacitor Filters

Sections Covered: Entire Chapter.

What you should know:

- (a) Know how a switched-capacitor simulates the behavior of a resistance. Know the equation for the equivalent resistance (Eq. 13.1).
- (b) Know the advantages, disadvantages, and limitations of switched-capacitor filters.
- (c) Understand the operation of simple switched-capacitor circuits such as the integrator, the summer, first-order section, etc.
- (d) Be able to change a continuous-time filter into its switched-capacitor equivalent. Be able to change a switched-capacitor filter back into its continuous-time equivalent.

## Chapter 14: Operational Transconductance Amplifier Filters

Sections Covered: Entire Chapter.

What you should know:

- (a) Understand the equivalent circuit and the properties of the OTA. Be able to analyze simple circuits containing OTAs. Know the transfer function of the OTA.
- (b) Understand and be able to analyze the operation of representative OTA circuits such as amplifiers, summers, integrators, lossy integrators, first-order sections, etc.
- (c) Know how to simulate grounded capacitors, grounded inductors, floating inductors, etc. with OTAs
- (d) Understand how OTAs can be connected to form various biquads. Be able to analyze these biquads.
- (e) Be able to simulate high-pass and low-pass filters using OTAs.
- (f) Be able to apply the leap-frog method to OTAs.