**Final Exam**
- Wednesday, March 22 10:15–12:05 pm
  - Two single-sided hand-written, sheets of notes (may photocopy tables of transforms or two-port parameters)
  - Will include two-port networks
  - Will include bode plots
  - Comprehensive (may include basic concepts from throughout the course)
  - Likely to include an op amp circuit analysis problem
  - May include short-answer questions about practical filters
  - May include frequency response of LTI systems

**Lecture Overview**

**Last Time**
- Continue Bode plots

**This Time**
- Finish Bode plots
- Practical filters introduction
- Brief course review
- Instructor evaluations

**Miscellaneous**
- Homework 7 returned
- Homework 8 due today
Course Review

- Fundamentals of signals
- Fundamentals of systems
  - Properties: causal, invertible, memoryless, stable, linear, time-invariant
  - LTI systems turned out to be the most important
- Convolution Sum/Integral
  - Enables us to calculate the output of any LTI system
  - Only need to know the impulse response
- Laplace Transform
  - Turns ordinary differential equations into algebraic expressions
  - Elegant method of handling initial conditions
  - Works with almost any signal

Course Review Continued (1)

- s-Domain Circuit Analysis
  - More general form of circuit analysis
  - Any network of all the circuit elements you learned in ECE 221
  - Independent sources can be signals
  - Can solve for any current or voltage in the circuit
  - Uses analysis techniques you learned in ECE 221
- Transfer Functions
  - Put the circuit in a box
  - The transfer function is \( H(s) = \frac{Y(s)}{X(s)} \)
  - Also turned out to be the Laplace transform of the impulse response: \( H(s) = \mathcal{L}\{h(t)\} \)
  - Relationship of pole locations to stability
  - \( A \cos(\omega t + \phi) \rightarrow |H(j\omega)|A \cos(\omega t + \phi + \angle H(j\omega)) \)
  - Synthesis = cascade of low-order components

Course Review Continued (2)

- Two-port Networks
  - Analogous to Thevenin and Norton equivalents
  - Two ports
  - Relates two port voltages/currents to the other two port voltages/currents
  - More general than transfer function analysis
- Bode plots
  - Frequency response helps us understand what the circuit/system is doing
  - Conventional standard of plotting the frequency response
  - Insight about poles and zeros effect on frequency response
- Practical Filters
  - Specifications used to generate \( H(s) \)
  - Established frequency-selective analog filter designs

Instructor Evaluations

- Why weren’t the exam scores for the first two exams better?
  - Falling behind? Too many other responsibilities?
  - Lack of mastery of ECE 221 techniques and concepts?
  - Didn’t realize you were unprepared?
  - Weekly online quizzes a good remedy?
  - Call on students in lecture by name?
- Homework solutions
  - Asset or disincentive?
- Cheating?
  - Did it occur?
  - Are counter-measures sufficient?
  - Are the assessment standards fair? (everyone treated the same?)