Reading in *Lathi*
No reading. Spend your time reviewing for the exam.

**EXAM ANNOUNCEMENT**
Exam 2 is **Thursday, April 5**. This exam will cover material through the lecture on March 29, *i.e.*, chapters 1-4 (the assigned sections) and problem sets 1-8. The exam will be closed book, but two \(8\frac{1}{2}'' \times 11''\) sheets of notes (both sides) are allowed. No calculators are allowed.

**Problem 4.9-3 in Lathi**

**ECE-220 Problem 13**
Sketch the Bode plot magnitude and phase for the following system

\[
H(s) = \frac{1}{s^2 + 14.14s + 100}.
\]

**ECE-220 Problem 14**
Consider the causal LTI system with transfer function \(H(s)\)

\[
H(s) = \frac{1}{s^2 + 510s + 5000}
\]

(a) Determine a differential equation for this system.

(b) Sketch the pole-zero plot for this system.

(c) Sketch the frequency response of this system.

(d) Determine the output when the input is \(x_1(t) = e^{-2t}u(t)\).

(e) Determine the output when the input is \(x_1(t) = e^{-2t+100}u(t - 50)\).

(f) Determine the output of this system when the input is \(x(t) = \cos(3t)\) for all \(t\).
ECE-220 Problem 15
Consider the cascaded system shown below consisting of two causal LTI systems:

\[ h_1(t) \quad H_1(s) \quad y_1(t) \quad h_2(t) \quad H_2(s) \quad y_2(t) \]

The first system has the impulse response given below:

\[ h_1(t) = 9.19e^{-4t}u(t) - 4e^{-2.5t}u(t) + e^{-t}\cos(3t + \frac{\pi}{4})u(t) \]

The second system has the transfer function given below:

\[ H_2(s) = \frac{s}{(s + 52)(s + 2.95)(s^2 + 2s + 3)} \]

The input to the system is \( x(t) = u(t) \). What is the steady state output of this system? Please think carefully before doing any lengthy calculations.

ECE-220 Problem 16  (Old ECE 220 exam question)
Consider the causal LTI system with transfer function \( H(s) \) given below:

\[ H(s) = \frac{1}{s + 10}. \]

(a) Determine the output of this system when the input is \( e^{j2t} \) for all time.

(b) Sketch the Bode phase plot for this system.

(c) Is \( H(s) \) the transfer function associated with the circuit shown below? The input is the voltage \( x(t) \) and the output \( y(t) \) is the current through the circuit. Why or why not?

ECE-220 Problem 17  (Old ECE 220 exam question)
Consider the causal LTI system with transfer function \( H(s) \) given below:

\[ H(s) = \frac{2s}{(s + 1 - j100)(s + 1 + j100)}. \]

(a) Determine a differential equation for this system.

(b) Determine the output \( y(t) \) of this system when the input is \( x(t) = u(t) - e^{3t}u(t) \).

(c) Sketch the pole-zero plot for this system.

(d) Sketch the frequency response magnitude of this system. Do not use a log scale, i.e., do not sketch the Bode plot.

(e) What type of filter is this system?
ECE-220 Problem 18 (20 points)
The following is known about a causal LTI system:
- The system has real poles and zeros.
- The system has the frequency response magnitude shown in the Bode plot in Figure 18.1. (The plot shows relative amplitudes only.)
- When the input is \( x(t) = \cos(10t)u(t) \) the output \( y(t) \) is shown in Figure 18.2.

Based on the clues given on the previous page, determine as much as you can about the system function \( H(s) \) for this system.