

QUESTIONS FOR ELECTRICAL & COMPUTER ENGINEERS

1. How does AM and SSB radio work? What exactly is bandwidth?
2. How can I use feedback to alter the behavior of a given system?
3. What is the spectrum of a signal, and why should I care?
4. Everything is digital now: transmission, storage, filtering.
When can I sample a signal without losing any information?
5. What does it mean to filter a signal? How do I do it?
6. How can I analyze circuits with several inductors and capacitors easily, without all of that $!@#\hat{*}$ differential equation stuff?
7. How can I design circuits to perform signal processing tasks?
8. When can I reconstruct a system from a single input and output?
9. How can I tell quickly whether a system is easy or hard to analyze?
10. How can I gain some insight about the behavior of some systems by performing some quick calculations on the system coefficients?

EECS 216 will answer all ten of the above questions during the term. The major topics of the course, and their significance, are as follows:

1. **LTI Systems** process input signals into output signals. They are:
 - a. Linear (response to scaled sum of inputs is scaled sum of responses)
 - b. Time Invariant (response to a delayed input is a delayed output)
 LTI systems are easy to analyze (#9) using the Laplace transform.
2. **Fourier analysis** of signals decomposes them into sinusoids.
 - a. This spectrum (#3) leads directly to sampling theorem (#4)
Altering the spectrum of signals defines filtering signals (#5)
 - b. The response of an LTI system to a sinusoid is another sinusoid.
Response to any input can be computed by filtering its spectrum.
3. **Laplace transform** and **transfer function** of LTI systems.
 - a. Easy analysis of LTI circuits with Rs, Ls, Cs and $\text{INITIAL CONDITIONS}$ (#6)
 - b. Reconstruct LTI systems from a single input-output pair (#8)
and characterization of their behavior with poles and zeros (#9)
enabling back-of-the-envelope calculations and design (#7, #10)
4. Simple **applications** of EECS 216 signals and systems concepts:
 - a. Application of Fourier analysis to simple communications (#1)
 - b. Application of Laplace to feedback analysis of LTI systems (#2)
 - c. Some simple processing of discrete-time (digital) signals (#4)

EECS 216 has weekly homework, 3 exams, 4 breadboard-based labs.
