Topics to Review: The following topics are fair game on the second exam. Remember, you are allowed to bring a review sheet to the exam that fills one side of an 8.5x11" piece of paper. Also remember to bring a calculator.

- First exam topics (not to the same level of detail, but you should still remember how to analyze and design circuits).

- Input/output impedance (too many people missed this on the first exam)

- Signal Processing

  - SNR
  - Noise (types, frequency characteristics)
  - Noise reduction approaches
    * Filtering
    * Coherent temporal averaging
    * Non-running, running and exponential averagers
    * Theoretical SNR improvements
    * Block diagrams describing averaging algorithms
    * Correlation
  - Frequency-domain Analysis
    * Fourier transform pairs for "common" functions, including delta functions, rects, sinusoids, combs, Gaussians, etc.
    * General properties of the Fourier Transform, including those outlined in the lecture handout
  - Convolution
  - Auto- and Cross-Correlation (properties of, how to perform the operation, why it is useful, etc.)

- Digital Electronics

  - Digital logic gates
  - Combinatorial and sequential logic
  - SR, D and JK flip flops
  - Registers, latches, counters and timing diagrams
  - Binary numbers
  - Analog $\rightarrow$ Digital
    * Bit resolution
    * Sampling rates and aliasing
    * Flash ADC
    * Successive Approximation ADC
    * Single-Slope Integration ADC
  - Digital $\rightarrow$ Analog
    * Resolution
    * Scaled-resistors into summing amplifier
    * R-2R Ladder

- Cardiovascular System

- – Heart and vascular anatomy; conduction anatomy
- – ECG signal
    - * What does it represent electrically?
    - * How is it measured?
        - · Eindhoven's triangle
        - · Wilson's Central Terminal
        - · > 3-lead configurations
    - * How does it related to other physiologic processes (e.g., contraction, blood pressure, etc.)
    - * Sources of noise and methods of minimization / compensation
- – Heart conduction abnormalities (what they are and how they manifest themselves in measurement systems)
- – Arrhythmias (what they are, how to diagnose, how to treat)
- – Pacemakers

Types of questions to expect: This exam will be different from the first exam. Expect questions that focus on block diagram design, understanding the physiologic systems mentioned above in the context of characterizing them (which includes knowing some factual information about them), and biosignal processing. You will be asked to evaluate a circuit in terms of what it does in the context of making a measurement.