BME154L (Palmeri, Spring 2010) **Exam #2 Tips**

Topics to Review: The following topics are fair game on the second exam. You are **not** allowed to bring a review sheet to the exam. Also remember to bring a calculator.

- 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.)
- 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)
  - Devices to characterize the cardiovascular system
    - Stethoscope
    - ECG Monitor
    - Blood pressure meters
    - Flow meters
  - Devices to intervene
    - Pacemakers
    - Defibrillators
    - Cardioverters
  - Blood pressure

        - Pressures in the body at different anatomic locations
        - Methods to measure pressure
    - Blood flow
        - Methods to measure flow
        - Design considerations
        - Ultrasonic flow meters (as covered in lecture)

- Respiratory System
    - Respiratory anatomy
    - Measuring gas exchange
    - Spirometry
    - Characterizing mechanical systems with circuit equivalents
- Biotelemetry
    - General functional blocks to achieve
    - Design considerations
    - Solutions to inherent bottlenecks/problems/concerns
- Electrical Safety
- Lab Topics
    - Second-order systems
    - Pneumotach
    - The functional components of the circuits used to make the measurements in lab
    - ECG signal analysis (overlap with problem sets)

Types of questions to expect: This exam will be very 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 may be asked to evaluate a circuit in terms of what it does (not solving for detailed voltages and currents like the first exam, but knowing how the signal is processed by different stages of a circuit) in the context of making a measurement.

Solutions for all of the problem sets have been posted on Blackboard.