1. ECE 527B (ECE 581B2): Biosensing: Signals and Noise in Biosensors

2. 1 credits: 2-80 minute lecture sessions/week – 5 weeks

3. Kevin Lear

4. None - readings and notes provided by instructor

5. Course Information
    a. Quantitative treatment of concepts of noise, interference and signal including noise types and spectra, filtering, and limitations imposed by noise. Example applications to biosensors.
    b. Prerequisites: MATH340, may be taken concurrently or MATH 345, may be taken concurrently; PH 142
    c. Selected Elective: Electrical Engineering; Computer Engineering; Lasers & Optical Engineering

6. Goals for the Course
    a. Course Learning Outcomes
        i. Describe major types of noise and their spectral dependence
        ii. Describe quantization error and its dependence on analog-to-digital convertor parameters
        iii. Relate signal to noise ratio to measurement confidence and limit of detection
        iv. Determine appropriate analog and digital filtering methods for improving signal to noise ratio
        v. Distinguish between interference and noise
    b. Student Outcomes
        1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
        2. An ability to apply the engineering design process to produce solutions that meet specified needs with consideration for public health and safety, and welfare, as well as global, cultural, social, environmental, and economic factors
        6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
        7. An ability acquire and apply new knowledge as needed, using appropriate learning strategies

7. Topics Covered
    Shot, thermal, flicker (telegraph), and quantization noise
    Units for characterizing noise amplitude
    Filtering methods
    Practical issues in applying analog-to-digital converters
    Interference
    Impact of amplifiers on signal-to-noise ratio, noise figure, design choices impacting noise
    Impact of noise and interference on sensitivity, limit of detection, measurement

confidence
Biosensing examples
Basic methods for characterizing noise; use of oscilloscopes, spectrum analyzers, noise meters, amplifiers