Medical Equipment I – 2013/14
Problem Assignment #1

1. What are the types of measurement error? Provide a list of error types with definition, source and example for each item on the list.
2. Give three examples of practical biosensors and identify their basic components, and their primary and secondary signals.
3. Comparing surface electrode to needle electrode, which of them has a larger source impedance? Explain your answer.
4. Do you expect resistive strain gauges to behave linearly with changes in strain? Explain your answer.
5. When using piezoelectric transducers to measure mechanical stress, how can forces be measured using this transducer in practice?
6. In measuring concentration as a biochemical signal using infrared spectrometer, explain how the used equation is related to Beer's law.
7. In infrared spectrometer, explain the advantage of using the chopper in the system.
8. By examining the table detailing the different bioelectric signals, do you expect interference between different bioelectric signals during measurement? Explain your answer and give examples.
9. For Doppler flowmeter, assuming original frequency to be 1 MHz, speed of sound in tissue to be 1540 m/s, an angle of inclination of 45 degree, what would be the Doppler shift range for the range of blood flow velocities in humans?
10. For a quartz microbalance of surface area of 5 mm^2 and resonance frequency at no load of 5 MHz, determine the frequency shift for a load of 1 ng.
11. If the absorption coefficient of a blood sample at 650nm was found to be 1000 and at 950nm was 200. Find the ratio of HBO_2 to HB that sample. Assume the absorption of HB at these frequencies to be 2000 and 150 and those for HBO_2 to be 200 and 300 respectively.