Laboratory Exercise 6: Design Problem
BME 489 Medical Instrumentation

Overview and Goals of this Lab:
The goal of this lab will be to conceptually investigate and design an instrument. Each group will pick a project (only 2 groups can work on the same topic). You will NOT write a lab report for this lab. You will prepare a 15 minute PowerPoint Presentation where your colleagues will grade you. Design instrumentation to meet the customer requirements. Each group will review their design followed by any questions from the class. Note you cannot go over 15 minutes during presentation. If you do go over, points will be deducted. You will be asked to stop where you may not present all material thus you may not present all topics that are graded (see grading below).

My suggestions on how to proceed:
Review the requirements
State assumptions
Discuss the block diagram
Draw out the circuit schematics for each block diagram making sure to include safety instrumentation
Discuss calibration/ maintenance procedure

Problem 1:
You are the design engineering team working at Heartbeat Diagnostics Inc. The product manager just met with the Vice President of Marketing and Sales who obtained the requirements for the next generation production from a panel of potential customers, selected cardiologists from major medical centers. The cardiologists want to buy a diagnostic quality ECG instrument that functions with a defibrillator and and Electro-Surgical Unit. For their application, they are only interested in viewing the ECG from Lead I and from Lead aVr. Based on preliminary data the LA signal has a 300 mV DC offset and the RA lead has a 200 mV DC offset and the LL lead has a 100 mV DC offset. The magnitude of the signal is approximately 1 mV.

Problem 2:
Design a blood pressure monitoring device to be used during surgical procedures. The surgeons would also like to have a display of internal body temperature.

Problem 3:
Design an electro-oculogram to measure eye movement.

Problem 4:
Design a pressure monitoring system to maintain the pressure inside the ventricles for children who have hydrocephalus.

Problem 5:
Design an electroencephalogram to monitor the alpha and beta wave activity using a bipolar configuration between leads O1 and O2.

Problem 6:
Design a pneumotachometer to measure breathing rate. The Pulmonologist wants to know the TV, IRV, and ERV.

Problem 7:
You are working for in a sleep lab and the staff would like an instrument to operate in a unipolar limb configuration and only view F2. They are interested in the delta and theta wave activity only.

Grading:
Print out 1 copy of Presentation for Dr. Alvarez
Presentation of Problem – 10 points
Presentation of Assumptions – 10 points
Block Diagram – 15 points
Details of Design – 20 points
Details of Patient Safety – 10 points
Calibration Procedure – 10 points
Maintenance Procedure – 10 points
Organization & Appearance of Presentation Materials – 5 points
Verbal Presentation Skills – 5 points
Did all members contribute to the presentation – 5 points