Stress is the undue physiological demand placed on the body when it must adapt, cope or adjust to unfavorable conditions. While it can keep a person alert and even be healthy, prolonged or intense periods of stress can be harmful to the body. *Acute* stress*,* the most common form, tends to be short term deriving from recent or future demands or pressures, for example an upcoming exam or presentation (APA, 2011). In contrast, *chronic* or long-term stress is often associated with health disparities which stem from stressors such as perceived discrimination, neighborhood stress, daily stress, family stress, acculturative stress, environmental stress, and maternal stress(Djuric et al, 2010; NIH, 2011). Long-term activation of the stress-response system can disrupt almost all of the body’s processes and increase the risk for numerous health problems (Mayo Clinic Organization, 2011; NIH, 2011).

In populations at risk for health disparities due to stress, there is a major need for the design, validation and application of novel technologies that measure and monitor stress. An ideal device for addressing stress disorders would use non-invasive or minimally invasive sensors to (1) assist individuals with monitoring and self-management of stress disorders, (2) provide metrics/data to assess/evaluate the efficacy of therapy to address stress disorders.

American Psychological Association. (2011). Stress: The different kinds of stress.

Djuric, Z., Bird, C., Furumoto-Dawson, A., Rauscher, G., Ruffin, M., Stowe, R., Tucker, K., & Masi, C. (2008). Biomarkers of psychological stress in health disparities research. Open Biomark Journal, January 1: 7-19.

The Mayo Clinic. (2011). Stress Management. http://www.mayoclinic.com/health/stress/sr00001

National Institute of Health. http://www.nih.gov/

**I. Phase I: Define the problem and design (4 weeks)** *August 17th-Sep 13th*

As a team, identify an at risk population your team will focus on, define a stress-related health disparity problem that population faces that your team will address and propose three design concepts to address the problem and that will create value for this population. These concepts must be backed by a demonstrated understanding of the value proposition, the relationships between the parameter(s) being sensed, the underlying pathophysiology, and the information the device will provide. To make progress, you will need to leverage what is known (through a review of existing research) while managing the uncertainty created by what is not known. In developing design concepts, keep in mind that you will need to justify your decisions using quantification (engineering considerations: measurement and estimates) and existing research (evaluate validity of resources).

* Design concepts presentation: Tuesday, September 8th (Team)
* Preliminary designs proposal: Sunday, September 13th (Team)

**II. Phase II: Modeling towards preliminary understanding (4 weeks)** *September 15th-October 11th*

Identify a question about your three device concepts or one device concept that you can answer through quantitative (mathematical and computational) modeling. BMED 2210 is an important tool in addressing this phase. Clearly define the input signal(s), i.e. quantities your device is measuring, the desired output of the device, and the intermediate steps between input and output in a conceptual qualitative model which can be understood by a non-technical audience. Select some portion of this conceptual model to quantitatively model.  Articulate your quantitative model’s purpose, and include only the most important properties and parameters that affect the function of your device in your model.  Your model must provide useful information to guide the development and testing of the prototype in Phases III and IV.

* Conceptual and quantitative model presentation: Oct 8th (Team)
* Report on findings from modeling Oct 11th (Team)

**III. Phase III:  Building a proof-of concept (4 weeks**) *Oct 13th-Nov 10th*

In this phase of the project every member of your team will build a first prototype of your device and develop software necessary to implement your design. This means you will need to purchase kits. While this may seem a daunting task for novices, there is a wealth of information available from the maker/hobbyist community on these technologies.  This will be the time when the team will really need to help each other out in dealing with both the hardware and the software. To assist you, we will be providing hands-on training on working with microcontrollers as well as hardware and software “consultants” who meet you either virtually or safety permitting on campus for assistance.  *There is no team paper for this phase.*

* Design Evolution presentation: Nov 10th (individual)

**IV. Phase IV: Experimental design and testing (4 weeks)** *November 10th-24th*

Design and propose an experiment to test/evaluate the performance of your device. As you will not be able to do this in person, this document represents a research proposal were you to have the population available to test. You will need to include background, a hypothesis deriving from this background experimental method, statistical method of analysis and expected results

* Experimental testing proposal presentation: Nov 24th (team)
* Testing Paper: Tuesday, Nov 24th (team)

**LAST DAY OF CLASSES:** Nov 24th

**FINAL EXAM:** Wednesday, Dec 2: The final exam will be over a 24hr period.

**NO EARLY EXAMS**