NORTHERN ARIZONA UNIVERSITY

# Memorandum

## Memo Analysis

**To:** Professor David Willy and GTA Connor Gaudette

**From:** Tensegrity Medical Light Therapy

**Date:** 11/1/24

**Re: Analysis Topics**

Tensegrity Medical Light Therapy has many unique analysis topics. These topics combine theoretical knowledge and practical application, building a strong foundation for engineering problem-solving. For this, Alicia will conduct a heat transfer analysis to find the thickness of the medical device's insulation; Claire will conduct a circuit analysis to analyze how the inner workings of our device will be programmed and set up; Norma will explore several advanced analysis topics that contribute to a comprehensive understanding of material and structure behavior. These analysis topics were approved by Instructor David Willy and our client, Jesslynn Armstrong. Below is more information regarding the individual analysis topics that each team member will conduct.

**Alicia**

For this analysis, I will conduct a heat transfer study focused on our device's insulation. The addition of insulation is essential to prevent the device from overheating and causing harm to the user. To perform this calculation, I will need to determine the temperature change and heat transfer rate of the insulation's surroundings and the thermal conductivity of the material of the insulation. Understanding these factors is vital for calculating the optimal thickness of the insulation, ensuring that the device remains safe for the user while still allowing the LEDs and sensors to function effectively.

**Claire**

For this upcoming memo, I plan on working with the electrical engineering students to plan out the circuit mapping of our device. This is a crucial task because we need to find a way to effectively and efficiently place all of our wires, nodes, lights, and sensors in a way that will optimize our design. We need to make sure that even with all the electrical components placed inside of the device, we still have to have an aspect of flexibility in our device; because of this, we must align the LEDs in a way that make the device still breathable and bendable. We have a lot of aspects to consider when working on this task, so learning from tools such as fritzing will help us a lot during the planning period.

**Norma**

In my engineering studies and project work, I have explored many analysis topics. One area involves stress-strain analysis for viscoelastic materials like polyurethane, where I can apply complex constitutive models to predict time-dependent deformation under varying loads, including creep and stress relaxation

behaviors. Additionally, I plan on working on thermal expansion analysis, incorporating energy balance equations and thermal properties to evaluate internal pressure changes within enclosures due to heat generation from the components withing the housing unit. For fluid dynamics in confined systems, I plan on engaging in calculations using Bernoulli's and continuity equations to model pressure variations and flow behavior within cooling mechanisms. Finally, finite element analysis (FEA) provided a platform for simulating complex geometries and material responses under multi-axial loading conditions, enhancing my ability to predict stress distribution and potential failure points with precision