Student Name _____ Date _____

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.237 Modern Optics Project Laboratory
Laboratory Exercise No. 6 **Spring 2023**

3-D Vision, Non-holographic 3-D Imaging, and Near-Eye 3-D Displays

To get the most out of your in-lab experience, you must come to Lab prepared (makes life easier for you and the TA and minimizes your time in the Lab). Thus, you should go through this Lab manual, complete the Pre-Lab Exercises, and answer all the Pre-Lab questions BEFORE entering the Laboratory. In your lab notebook record data, explain phenomena you observe, and answer the questions asked. Remember to answer all questions in your lab notebook in a neat and orderly fashion. No data are to be taken on these laboratory sheets. Tables provided herein are simply examples of how to record data into your laboratory notebooks. Expect the in-lab portion of this exercise to take about 3 hours.

PRE-LAB EXERCISES

PL6.1 – Get Prepared to Start the Laboratory Exercises

Read the **entire** laboratory handout, and be prepared to answer questions before, during and after the lab session. Determine all the equations and constants that may be needed in order to perform all the laboratory exercises. **Write** all of them in your laboratory notebook before entering the Lab. This will ensure that you take all necessary data while in the Lab in order to complete the lab write-up. This preparatory work will also count toward your Lab Exercise grade.

PL6.2

Be creative! Design a 3-D display that you can build in the lab, and that is viewable with or without polarizing glasses. Assume you have a lenslet array, a sheet of linear polarizer material, diffusers, readout light sources, etc.

If your imagination is failing you, here are two options that may get you going:

(a) Consider building the glasses-free integral imaging system that you designed as a homework problem.

(b) Make a pair of polarizing eye glasses by cutting two small samples out of a large sheet of

linear polarizing material and mount them on a cardboard frame. Then take two images (left eye view, then right eye view) of your favorite object with your cell phone camera. If somehow you can get your phone or computer to cycle back and forth between these two images at 30 frames per second on your screen, then you can mount a sheet of polarizing material on a rotating wheel, and spin it in front of the display on your phone. You should then be able to see the image in 3-D through your glasses.

For your design, make a drawing of the system, label all components and specify the sizes and dimensions of all its parts.

IN-LAB EXERCISES

6.1. Build your own Near-eye 3-D Display System

Bring your pre-lab design ideas to the MOL. We will discuss them with you, and together we will arrive at a consensus as to what you should build.

or

6.2 Stereoscopic 3D Imaging with laptop and polarizers

See for example, the stereoscopic system built by Bahrudin Trbalic (Appendix 1 of class notes)

or

6.2 Integral Imaging with cell phone as the recording and playback device

See for example, Zac Gromko Final Project report (Appendix 2 of the class notes)