1. (10 points) What are the objectives of this lab in your own words?

The objectives of the lab are to learn how to

- use the PASCO tool kits and accompanying software,

- accurately record and post-analyze data using tools like smoothing and curve fitting, and

- write a complete lab report using the provided template.

2. (10 pts) What are the PASCO tool kits? (10 pts) What components of PASCO tool kits are used in this lab?

The PASCO tool kit is a set of building materials, sensors, and devices that interface with the PASCO software. The kit helps analyze and test materials by recording high-fidelity data to a computer which can then be exported in .txt or .csv format to other software such as Python or MATLAB.

In this lab, we are utilizing the PASCO displacement sensor, ultrasonic sensor, the universal interface, and the software to measure the displacement of a beam after forces—some random and some sinusoidal—disturb it from its steady-state.

3. (10 pts) What are the advantages of using the PASCO tool kits?

The components/sensors in the PASCO tool kit are accurate, easy to set up, modular, and all interface with a universal software to record their data. We can precisely define the terms of our experiment and record from multiple sensors all within the same software. The PASCO tool kit allows us to make quantitative assessments of material and compare the results to the theoretical expectations.

4. (15 pts) What experiments will you be doing in this lab? Provide descriptions in your own words.

The first experiment involves only the PASCO wave driver. Using the PASCO wave driver to generate the oscillations, we will utilize the displacement sensor (needle) and the motion sensor (ultrasonic) to measure or track the position of a beam that is meant to represent an airplane wing.

During the second experiment, we will add a weight hung with a spring to a different section of the beam and apply an arbitrary impulse on the weight during the experiment. This arbitrary impulse with the weight simulates error or random perturbations during the flight of an aircraft. Only the motion sensor will be used to record the position of the beam.

For the final experiment, we will introduce one additional component of randomness: one of our group members will randomly apply a force in an arbitrary normal direction to the beam during the experiment. Again, only the motion sensor will be used to record positional data.

Again, these experiments are meant to simulate in kind the type of random and oscillatory movements an aircraft wing may undergo during flight.

5. (10 pts) What will your group be doing with the data collected in the lab? (4 pts) In terms of

data processing, what are the two main techniques?

Before leaving the lab, all data will be transferred to the cloud or a to a flash drive where it will be processed later. We will import this data into either MATLAB or Python to plot the data and perform further post-processing to clean up the data. The two primary techniques we will use for data processing are running-average filters with either single or multiple passes and after this smoothing, we will utilize MATLAB/Python to generate a line of best fit appropriate for the data.

If done correctly, a line of best fit matching the first experiment—which was purely sinusoidal with no random perturbations—will allow us to identify when the random and artificial disturbances occurred since they will be shown as deviations from the expected sinusoidal curve.

Total 65 points