Instructions:

* Replace the highlighted areas in yellow above with your own name, section and group numbers and correct dates,
* Watch lab demo video and review related materials in lecture notes, lab manual and other related documents,
* Provide your best answers to the following questions. Add pages as needed,
* Convert this Word worksheet sheet into pdf format and submit to Canvas.

**1.** In your own words, state the following about this lab: (1) the objectives (5 points), (2) the key concept learned and its benefit (10 pts).

**2.** (5 pts each) In your own words, describe the functionality of the following components of the PASCO tool kits: (1) wave driver, (2) load cell, (3) motion sensor, and (4) displacement sensor.

**3**. (5 pts each) Continuing from 2., based on the lab manuals state the operation specifics and any particular “pitfalls” associated with each of the components that you will need to pay attention to.

**4**. (10 pts) As you have heard, this lab will be the “term project” of the course and will be heavily weighted. Based on the lab manuals, what are the criteria for grading?

**5.** (15 pts) Following 4., what are the project topic and working plan and scope you (or your group if a consensus has been reached) are considering (to earn you a perfect score)?

Total 80 points

Answers:

1. In this lab we will design, build, and analyze a structure model of a part of an aircraft using the PASCO kit. For the analysis, we will subject our structure to static and dynamic vibration, collect data, and compare it to theoretical values. The key concept we are learning is “rapid design, prototyping, and learning.” This concept is useful if you need to go through the cycle of design, construction, testing, and analysis in a short period of time. This skill will definitely be useful later in our careers as aerospace engineers.
2. (1) The wave driver is responsible for applying vibration to structures by creating mechanical waves. (2) We use the load cell to find what type of load is occurring in the middle of a beam that is part of our structure. (3) The motion sensor can be used to measure displacement, velocity, and acceleration. (4) The displacement needle is used to measure displacements that are no greater than 1 cm.
3. (1) The wave driver amplitude diminishes with increase of frequency. Set lower voltage for lower frequency, and higher voltage at higher frequencies. The frequency range of 5-100 Hz should be good enough for our analysis. It should NEVER make direct connection to our structure, we should use flexible interfaces such as rubber bands to intermediate that connection. Turn on the mechanical switch under the wave driver to unlock position before use. (2) Be aware of the load cell size in order to fit it inside your model. Look into the calibration setting in Capstone and make sure they are balanced. (3) The motion sensor needs to be at least 30 cm away from the structure. The model needs to have sufficient surface normal to the sensor surface. We may need to try-and-error with different sampling rate, as it may not sample fast enough if your model vibrates too fast. (4) The displacement sensor can give you more reliable data compared to the motion sensor fi the vibration frequency is fairly low.
4. The criteria for grading this lab are: how creative our idea is; how complex (to build and to analyze the acquired data) our structure is; it needs to be a model or at least related to an aircraft structure; it needs to have an established objective and hypothesis, sufficient data to support it, and relate to the theory (or explain why it is not matching); the report needs to be complete, formatted, and accurate (we can get extra points for doing a video presentation of our project).
5. My idea is to design a model of a vertical tail. The design would be similar to that of a wing, but it would be positioned vertically and be “fixed to the aircraft” through the bottom end. We could simulate lateral gusts and vibration coming from the “fuselage” (bottom fixed structure). Our group decided that we will decide on the project topic and working plan after we have the opportunity to have access to the PASCO kit tomorrow during lab (it will also be easier to discuss about it in person).