Suggested Laboratories for: Engineering Measurement Techniques and Statistics ENSC 280

Date: October 17, 2008

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There will be three laboratories in the proposed course. Students are asked to write individual reports. The emphasis will be on engineering applications; Matlab will be extensively used. The following provide a brief summary of the suggested experiments:

- **Describing a Process:** The purpose of this laboratory is to introduce students to a systematic approach used to help organize any general empirical problem solving experiment. It is based on 5 steps: 1) Problem, 2) Plan, 3) Data, 4) Analysis and 5) Conclusion. This will be done by a laboratory study where students will work through an example of PPDAC, generate a set of observations, make measurements, and assess various attributes of a process. Students will use empirical problem solving techniques to improve a process. The idea is to identify problems within an existing process. Then the process is studied using PPDAC, which leads to understanding and hence ways to make the process more efficient. As an example, the problem of locating a drilled hole in the manufacture of metal parts will be studied.

- **Regression Modeling of a Strain Gauge Mass Scale**: In this experiment students will use two strain gauges mounted on a cantilever beam to approximate the mass of four unknown weights. This will be done by calibrating the system using a linear regression model. There are three parts to this lab: 1) To build a Wheatstone Bridge Circuit (WBC), 2) To calibrate the cantilever-strain gauge system with known masses, 3) To approximate the mass of unknown weights using the calibrated system WBC.

- **Factorial Experiment, Paper Helicopter Design**: Factorial experiment design is an important technique for engineers because: 1) it is far more economical than one at a time testing and 2) it is the only method for detecting interaction effects. Factorial experimentations are often performed by engineers who are debugging a complex problem, designing a product or optimizing a process. In this experiment, students will apply factorial experiment method by performing a set of design changes to affect the flight of a helicopter; then they will study the effects of the major parameters and their interactions with the design.