Research Fellowship Application

Title of Research Fellow Project – Physics Laboratory Design and Development

Faculty/Staff Supervisor – Dr. Michael Olson

Description of Research Project – This project will involve the research and development of up to three new physics laboratory exercises from the introductory to advanced levels.

Description of Student Opportunity – This project will provide an opportunity for the student to be the primary researcher/developer of three new physics laboratory exercises:

1. *Faraday’s Law* – The development of this introductory-level laboratory is intended primarily as training exercise, allowing the student to gain familiarity with our automated data acquisition and analysis platforms while learning fundamental research techniques in a more professional, as opposed to classroom, setting. It is intended that the result of this work, including relevant documentation, would be introduced into our first-year laboratory sequence in the spring of 2019.

2. *Timoshenko Oscillator* – First developed at the Université Paris-Saclay¹, this apparatus involves a novel combination of Legos and an Arduino microprocessor to measure the coefficient of kinetic friction between two materials. This project will involve both mechanical design and the programming of an automated data acquisition, analysis, and control system. The student would also have the opportunity to design and 3D-print an improved mechanical apparatus to replace the original Lego-based design.

3. *Thermal Conductivity* – This project involves the development of a new, advanced-level thermodynamics laboratory exercise to measure the thermal conductivity of a metal, utilizing an Arduino microprocessor and industry-grade sensors to fully control the sensor calibration, data acquisition, and analysis.

Benefits to the Student – This program is intended to provide a motivated student the opportunity to gain valuable research and development experience early in their academic career, and serve as a stepping-stone to higher level university or industrial internship opportunities in physics or engineering. Specifically, the student will gain experience in the areas of:

- experimental design
- research and development methods
- microprocessor programming/coding
- data acquisition and analysis
- design and 3D printing of parts.
- scientific/technical writing

¹ See attached article, “A study on kinetic friction: the Timoshenko oscillator”. 
**Benefits to the Supervising Faculty/Staff Member** – The outcome of this project will directly contribute to the improvement of both the introductory and advanced physics laboratories through the introduction of new laboratory exercises that I as a faculty member do not have the time to fully research and develop.

**Research Fellow Qualifications:**

- Major in Physics, Physics Education (Secondary), or Pre-Engineering **required**
- One year of high-school physics **required** (AP preferred)
- Interest/experience in working with electronics/robotics desirable
- Interest/experience in programming desirable