

## IPBT Equipment and Supplemental Lottery Request Justifications

### **Astro**

#### *Spectra Measuring Device*

The most powerful tool in research astrophysics is spectroscopy. At this time, the Astronomy program has to rely on videos to acquaint students with spectroscopy and its applications, but having these hands-on, interactive devices would provide students with a much more effective introduction to the power of spectroscopic analysis.

#### *8" Cassegrain Telescope*

The new lab course has been a very successful addition to the Astronomy program. Sections fill early in the registration process, and we hope to increase the number of sections to fill student demand. However, the Astronomy program does not have a telescope for the students to use or inspect. Instead, we have to borrow equipment, if it's available, from Community Education's Planetarium staff. Having our own telescope would not only greatly enhance students' engagement in the laboratory course, but it would allow the Astronomy department to conduct periodic public outreach viewing events independently of Community Education.

Both items will significantly improve our ability to provide direct hands-on experience to students and improve student understanding and engagement, (hopefully) with consequent improvement in student retention, success, and equity. Astronomy has one of the highest productivities of any department and efficiently serves a large number of students. Both items will therefore impact a large number of students in all lecture and lab astronomy classes.

### **Chem**

#### *Hotplates*

#### *Pipettes*

#### *Electrodes (Enhanced Lottery)*

All requested items are for the replacement of worn and broken equipment that are basic to chemistry laboratory courses. Over the years, hotplates and pipettes have become dysfunctional, and this request allows for an orderly replacement policy over a 15 year life-cycle. Their replacements will serve between 12 and 16 lab sections per year. The electrodes are consumed in the lab over a much shorter period, and rarely are functional after a year or two. Their replacements will serve approximately 25 lab sections per year. All items will be combined with existing working items and would also allow for a planned expansion in very high demand chemistry offerings.

#### *NMR USB Interface (Priority 2)*

This device would enhance and expand the current use of our nuclear magnetic resonance (NMR) device and allow for a more frequent and flexible use of our instrumentation in chemistry

labs. It will also enhance curriculum and allow more modern chemical experiments. The equipment upgrade would serve about 13 chemistry lab sections per year.

## **Engineering**

*Arduino circuit board kit*

*Oscilloscopes*

*Multimeter (priority 2)*

*Circuit simulation software (enhanced lottery)*

This equipment will allow us to continue to increase the number of lab stations available to students in engineering 10 and 37 courses. The engineering courses have had great student success (overall 91%) and a 0% equity gap. One of the important factors in this success has been a change to a hands-on approach to teaching, including labs and student determined projects. The requested items will allow us to move from 4 students per engineering station to 3 per station, and significantly enhance the engagement of individual students in the program. The multimeters would provide similar enhancements, though they are not as critical as the other items.

The circuit simulation software would provide students in Engineering Circuits classes with modern tools typically found in the commercial engineering environment. Once again, this equipment would significantly enhance hands-on and visual aspects to teaching engineering, an approach which has led to the high success rates and low equity gap of the department.

## **Geology**

*Vertical seismometer*

This request will provide all geology sections access to local seismic data, and will significantly enhance the lecture and lab sections by providing students with both a hands-on approach to data acquisition and analysis and a more relevant curriculum based on local seismic events. Rather than just looking at data in a textbook, students can actually see the measuring device and participate in their own investigations. Developing a more hands-on and student-relevant approach has shown to increase student engagement and improve success, retention, and equity.

## **Math**

*Laptops*

### *Matlab software (Enhanced lottery)*

These laptop computers and software would provide an additional classroom laboratory environment. Our current computer lab facilities are solidly booked and additional space is needed to accommodate the ever increasing use of mathematics software in statistics and mathematics classes. The requested twenty computers would allow an existing “math” classroom to be used as a dual-purpose environment, both in normal lecture mode and as a computer enhanced classroom used by pairs of students. Computational experience is an articulation requirement in statistics and several other mathematics courses, and increasing use of visualization and other software learning enhancements to curriculum provide mathematical learning modes that benefit a very wide range of students. The computers and software could be used in any of the more than 200 sections of mathematics offered each quarter. The software would be available in several math computer labs.

### **Meteorology**

#### *Handheld weather meters*

Acquiring a class set of Kestrel weather instruments would allow Meteorology classes (both lecture and lab) to gain hands-on experience with accurately measuring many of the key weather conditions, including Temperature, Barometric Pressure, Wind Speed, Humidity, etc. The proper measurement of many of these variables is discussed in both courses, but is never practiced due to lack of instrumentation. A hands-on approach is much more engaging and local weather measurements are much more meaningful for students. The equipment would be used in all meteorology classes as well as shared with oceanography.

### **Physics**

#### *Laptops*

#### *Laser*

#### *Optics Experiment Set*

The laptops are to replace 8 year old Dell desktops in the physics labs, 6 of which are no longer functional. These computers are used by all physics classes, with over 2500 students per year using them for data acquisition and analysis in their physics laboratories. These are an essential replacement item critical to the functioning of our physics classes.

The lasers and optics experiment set are replacement for worn and broken laboratory equipment that are more than 15 years old. Again, these are essential in order to continue the normal functioning of our physics labs.