A Materials Science Laboratory Serves a Program

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Abstract

Most of the time a laboratory is used to serve one course, which may or may not be offered every term during the academic year. This paper suggests a way to utilize one lab, in this case a materials science lab, to serve other lab courses across the curriculum. Minimum lab elements, along with their development, are described. Courses that may benefit from this lab are listed, as are the requirements for implementation.

Introduction

The mission statement for the Manufacturing Engineering Technology program at Oregon institute of Technology (OIT) states that "this program is to offer an education that will provide the greatest opportunity for rewarding and successful careers" in this field. Students become well versed in the theory of manufacturing science through classroom activity. Extensive laboratory experience is provided so that the student becomes equally well versed in the applications of manufacturing science theory.

In a manufacturing engineering technology program, labs are used extensively, which serve to provide an applied emphasis to the students educational activity. At Oregon Institute of Technology, all major areas of study in this program are supported by an accompanying lab. This applications-oriented approach is the backbone of engineering technology education. For this reason the quality of the lab experience offered to the student is key to success, not only in completing the program, but even more importantly in his/her future work.

Laboratory experiences are typically offered directly relating the subject to classroom activity. This results in labs being used intensively during the time when those classes are offered. However the labs stand idle for long periods of time when these classes are not offered. How interesting it would be if one lab could serve more than one element of the program.

Suggested in this paper is a way to maximize the use of one laboratory to serve an entire program. One lab providing quality additions to nearly every other lab that is offered. The maximum use of this facility includes not only its own topic, but simultaneously offers supplemental learning experiences to other labs throughout the academic year.

This paper deals with the organization and implementation of a laboratory, in this case a materials science lab, and shows how it can serve nearly every other lab in the manufacturing engineering technology program.

A Modern Materials Laboratory

A materials lab comprises three basic elements. The metallography section, the microscopy section, and the photography section.

Metallography is the preparation of specimens for microscopic examination. Included is the cutting of a specimen to size, identifying and sawing or otherwise cutting a specimen at the appropriate place so as to expose a feature to be examined. This is followed by mounting, polishing, and etching, as appropriate, for microscopic examination.

A microscopy section would include an optical microscope with magnification capability from 50x to 400x. The optics on this microscope must be of high quality so that specimens can be examined in a distortion free manner. Microscope features should include polarized light and various contrast filters. There should also be a stereo microscope as a second instrument. A stereo microscope allows surface examination of specimens to reveal topographical features that are not discernable on the optical microscope. These two microscopes represent the minimum requirements for a microscopy element in the materials lab. Other desirable instruments include various loupes that

would allow macroscopic examination of specimens, and other microscopic instruments that might be desirable to the lab manager. All microscopes must have photographic capability, including exposure timers, light meters, etc.

The third element is the photographic section. In materials science, most evidence is presented in photographic form. 35mm, with both color and black and white capability, along with polaroid capability, is required equipment for both microscopes.

This section should also include the capability of doing various technical photography *in situ*. this would require free-standing 35mm cameras, appropriate attachments such as light meters, automatic exposure, etc. Appropriate tripod and specimen lighting capability is also required. Portability of photography equipment is desirable.

Integration of the Materials Laboratory into the Program

Several labs have been identified as benefitting from the materials lab. Welding, machining, casting and finishing methods are obvious candidates for providing enhanced educational experience through metallographic specimen examination. Other classes that may benefit from this type of examination would be senior projects and group projects. In these classes, perhaps not every project would require metallographic examination, however many of these projects would be greatly enhanced by doing so.

Nearly every lab would benefit from technical photography support. From Oregon Institute of Technology's manufacturing engineering technology program, the following list has been identified as benefitting from technical photographic support:

Manufacturing Analysis and Planning
Geometric Dimensioning and tolerancing/Metrology

Tool Design
Manufacturing Controls
Assembly and Testing Methods
Robotics
Computer Integrated Manufacturing

Implementing the Plan

All department faculty would be fully informed and instructed in the materials lab capability. Of course, the use of the lab is optional. Its value and contribution to any other lab or area of study would be determined by the instructor of that lab. Assistance would be provided to all professors to incorporate the materials science lab facilities into the curriculum for their area of expertise. Full support from the materials science lab would be provided to anyone who wants to avail themselves of these facilities.

Technicians would be available that are experienced and capable in the use of the materials science lab facility. These technicians would be provided to perform actual experimental work that would support the other labs.

Graduate and undergraduate students would have the opportunity to work in the materials science laboratory to gain expertise in all of the techniques employed within the lab. These students would be selected on the basis of their experience and interest in material science. This would afford them the opportunity of gaining an area of focus within their own field of study.

The lab would be under the direction of a professor with considerable experience in the area of materials science. This professor would be responsible for full operations of the materials lab, its services, and the training of lab personnel.

Conclusion

Integration of facilities such that one laboratory can serve several areas of study within the manufacturing engineering technology program is a way of maximizing available facilities. Using

a materials science lab to serve many other labs in the program will provide efficient use of available equipment and laboratory facility funds, personnel, and laboratory space.

Required to implement this plan is:

1. Initial funding to set up the lab properly.
2. A qualified person to develop and implement the plan.
3. Cooperation from the institute and the department.
4. Funding to sustain the services being offered.