

An Engineering Course Which Fulfills a Non-Major General Physical Science Requirement

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Abstract

In recognition of the increasing utilization of technology in our society, an Engineering course which fulfills the general science requirement as a physical science has been taught over the last six years at the University of San Diego. The course is taught by full-time engineering faculty to non-engineering majors.

Engineering 2: Introduction to Electro-Technology, is an introduction for non-engineering majors to electrical and electronic technologies that are encountered daily. The class is structured as a three hour lecture course. Although some simple mathematical concepts requiring competence in high school algebra is required, the majority of the material strives for conceptual understanding of the underlying science of the specific technologies discussed.

The course has three purposes:

1. Students learn of the underlying scientific concepts of the technical tools used today
2. Essays on the impact of specific technologies on society are assigned to students to encourage critical thinking
3. Through discussions and technical problem-solving assignments, sufficient scientific literacy will be achieved meriting fulfillment of a non-laboratory General Education Requirement in the Physical Sciences.

I. Introduction

In typical Engineering programs, there is desire to integrate technical education with traditional liberal arts studies to educate a well-rounded engineer. Those studies include written and oral skill development, exploration of human existence through studies in philosophy and religion, and analysis of ethical issues. The liberal arts studies are usually an integral part of an engineering curriculum.

Through this integrated approach to technical education, the Engineering graduate is prepared to become a responsible member of the technical community, and society as a whole.

Unfortunately, there is fragmentation of knowledge in the undergraduate liberal arts experience brought forward by forcing a broad sampling among traditional liberal arts disciplines. The fragmentation appears to be caused by the "idea that the undergraduate curriculum is a series of (traditional) specialties to be dipped into lightly by all students."¹ By offering some General

Education courses that teach not only the general foundations of that specialty, but integrates that knowledge to the human experience as a whole would greatly enhance the overall goals of liberal arts study of the non-engineering and non-science/math major.

II. A General Education Engineering Course

Reduction of fragmentation of the general education science requirement at the University of San Diego was made beginning in the Spring 1992 semester. The vehicle chosen is a course taught by the Electrical Engineering program for non-engineering and non-science/math majors entitled, "Engineering 2 - Introduction to Electro-Technology" which is taught every Spring semester. This new technology course is unique in that it fulfills the General Education Physical Science requirement for non-engineering and non-science/math majors. The goal of Engineering 2 are:

1. Provide an additional opportunity for General Education study in science and technology in the liberal arts curriculum which develops the foundation sciences necessary to understand the nation of fundamental technical applications.
2. Integrate the scientific and technical perspectives which permeate modern life.

The ultimate hope is that students will be more technically literate to make intelligent decisions in their lifetime regarding technical and scientific issues which impacts society.

In Engineering 2, non-engineering and non-science/math students experience the technical concepts behind the modern technologies which are encountered daily. Demonstrations are given to highlight the basic principles behind these technical tools.

An innovative feature is the requirement for several critical essay assignments to explore the societal impact of certain technologies. The assessment procedure includes re-writing the essay without penalty of grade reduction to encourage clarity of thought and to enhance dialog between the student and instructor.

Journal notebooks have also been required in the past to aid in the learning of difficult concepts through self-dialog^{2,3}. These journal notebooks include assigned "mini-essays" which typically do not exceed two handwritten pages. The topics of these assignments are brief descriptions of a technical concept encountered in class. Examples of mini-essay questions are:

1. What is the electrical concept of ground?
2. How does the Universal Product code work?
3. What principles cause electric shock from a toaster?

In addition to critical essays and journal notebooks, free-writing exercises have been liberally used to encourage student participation in discussions. In-class group activities have also been used to stimulate active learning by the students.

Traditional quantitative problem assignments are given to solidify the physical science and mathematical aspects of technological concepts and inventions. Examinations are also typically quantitative.

From the onset, it was understood that Engineering 2 as a technology course must evolve with time. As such, the course topics have shifted in recent years. Recent topics in Engineering 2 include energy and information, safety and liability, and webpage design coupled with an introduction to electronic media and the internet⁴. Although the course has evolved with time, the basic premise is that it is a General Education Physical Science course and must therefore require significant analytical concept development.

III. Conclusion

The underlying physical science in technological concepts and inventions are discussed in Engineering 2 to satisfy the spirit of the Natural Sciences (Physical Science in particular) General Education Requirement at the University of San Diego: The Natural Sciences General Education Requirement is intended to foster a critical appreciation of the varied ways in which people gain knowledge and understanding of the universe, of society, and of themselves, and to provide an informed acquaintance with forces and issues that have shaped the present and are shaping the future. Engineering 2 has succeeded in providing basic technical literacy to liberal arts and other non-science/math majors using diverse teaching tools, which are typically used in liberal arts courses, to enhance the student learning experience.

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