

OPTICS FOR SCIENTISTS AND ENGINEERS

Orven F. Swenson¹, David A. Rogers², Floyd M. Patterson³, and Andres Campiglia⁴

Abstract *34* Faculty members from three departments at North Dakota State University (Physics, Electrical and Computer Engineering, and Chemistry) have cooperated to develop a joint program in optical science and engineering. An option in Optical Engineering has been established within the major in Electrical Engineering and an option in Optical Science and Engineering has been established within the major in Physics. A core course, "Optics for Scientists and Engineers," was introduced in Fall Semester, 2001 and is being offered again in 2002. This new course provides students with the fundamentals necessary to enable them to successfully apply optics in their respective majors. Students learn applied optics through a sequence of multidisciplinary laboratory experiences. This course was adapted from a similar course in the Optical Science and Engineering Program, New Jersey Institute of Technology. During Fall Semester 2001, seventeen students successfully completed the course. Interest in the course offering in the fall of 2002 is high. In general the course has awakened an interest in optics among engineering and science majors.

Index Terms *34* electrical engineering, laboratory course, optics, physics.

INTRODUCTION

A rigorous course in applied optics has been developed at North Dakota State University (NDSU) through the cooperation of three departments at the University: Physics, Electrical and Computer Engineering, and Chemistry. This course was modeled after a course that originated at New Jersey Institute of Technology in the Optical Science and Engineering Program [1]-[2]. The new course, Physics/ECE 411/611, Optics for Scientists and Engineers, was introduced in Fall Semester, 2001 and is being offered again in 2002. The primary goal of this new course is to provide students with the fundamentals necessary to enable them to successfully apply optics in their respective majors. It is a course in which students learn applied optics through a sequence of multidisciplinary laboratory experiences. This is accomplished through hands-on use of state-of-the-art equipment to experience and understand the most important concepts and phenomena of optics (including fiber optics). The course is open to students in engineering and science who have the appropriate backgrounds. This is a senior-level

or first-year graduate course with prerequisites of University Physics II (Electricity and Magnetism) and the corresponding level of calculus. Offering three credits, this one-semester course consists of 30 hours of lecture and 45 hours in the laboratory. The schedule is as follows: (a) first two weeks: three one-hour lectures per week; (b) ten weeks: two one-hour lectures and one three-hour lab per week; (c) three weeks: laboratory five hours per week to work on major-related experiment; and (d) one week: students present results during three classroom hours. Lectures are based on Eugene Hecht's *Optics* [3] to provide the background required for performing the experiments. The laboratories are scheduled in three-hour blocks. Students are paired to maximize their hands-on experience. A graduate student teaching assistant is present in the laboratory for all the groups. During the first offering of the course, a member of the faculty teaching team was also present during each laboratory session. In the next section the position of this course in the curriculum along with two more goals for the course will be considered.

OPTICAL SCIENCE AND ENGINEERING OPTIONS

Optics plays a significant role in many areas of science, engineering, and medicine since it can be both a conveyor and sensor of information and energy [4]-[5]. Since 1999 NDSU faculty members from the College of Engineering, and Architecture and from the College of Science and Mathematics have been developing a joint program in optical science and engineering. In Engineering and Architecture, an option in Optical Engineering has been established within the major in Electrical Engineering. In Science and Mathematics, an option in Optical Science and Engineering has been established within the major in Physics. Aside from this option, Physics already has an option in engineering physics within its major in Physics. The option in Optical Engineering is the eighth option available to majors in Electrical Engineering. The other options are Biomedical Engineering, Communication and Signal Processing, Computer Engineering, Control Engineering, Electromagnetics, Electronics and Microelectronics, and Power Systems. Students in the Department of Electrical and Computer Engineering can also major directly in Computer Engineering. These physics and ECE majors (i.e., all options) lead to the B.S. degree.

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