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An Analysis of the UCF Optics Ph.D. Curriculum

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Abstract

Graduate degrees specializing in optics have been offered at the University of Central Florida since 1987, with stand-alone Optics degrees being offered since 1998. In 2002, the Optics Ph.D. core was radically changed to allow students to take the PhD qualifying examination earlier in their studies, while still providing a broad and rigorous grounding in optics. This involved the creation of several new courses. We describe how this new system has worked over the first three years. We also discuss results of a study on how well typical admission criteria such as GRE exam results, grade point average, etc. predict student performance in our program.

Key Words

Optics, Education, Graduate Education.

Summary

1. Background

The faculty of the Center for Research and Education in Optics and Lasers (CREOL) at the University of Central Florida (UCF) have been actively involved in Graduate education in Optics since 1987. In the early years, students studied in Optics tracks in the Electrical Engineering (EE) and Physics graduate programs, but in 1998, the School of Optics was formed out of the CREOL faculty with its own graduate degree. In 2004 the School became a College, and as of fall, 2005 over 130 graduate optics students are enrolled in its MS and PhD optics degrees. Additionally, approximately 20 graduate students from other programs are working on theses and dissertations with CREOL faculty as their advisors.

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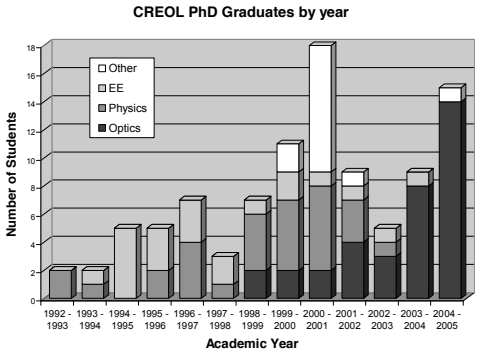

Figure 1. Number of PhD graduates with dissertations supervised by CREOL faculty for each academic year.

Since 1987, a total of 116 PhD students have graduated under CREOL faculty. The rate of doctoral graduations per year, along with their academic degrees is charted in Fig. 1. The dip in 2002-2004 is partly due to the large number of students who elected to leave without PhDs for jobs in industry at the peak of the telecom boom in 1999-2001. It is noticeable that since the PhD in Optics became available in 1998, most students coming to UCF to study optics have chosen this option over tracks in Physics or EE.

In Fig. 2, we chart the rate of graduation of MS students versus year. It can be noticed that the same trend toward the optics MS program is seen. This is not surprising, since most of the Optics MS degrees are non-thesis and are obtained *en-rout* to the PhD. Approximately 2/3 of graduates take employment in industry while 1/3 find academic positions (including post-doctoral positions.)

Recently, core courses and other popular graduate optics classes have been offered to students at remote locations via streaming internet web cast. This allows for both synchronous and asynchronous instruction and involves minimal disruption to our students on the main campus taking live classes. Currently approximately 10% of our course enrollment is to distance education students.

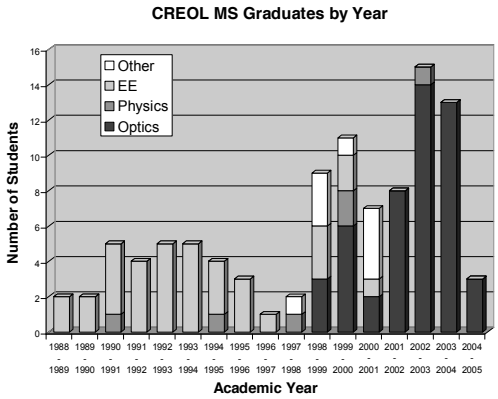

Figure 2. Number of MS graduates versus academic year. Here Optics MS includes both thesis and non-thesis options, but the other disciplines only include those where the thesis was supervised by a CREOL faculty member.

2. PhD Core

Table 1: PhD Optics Core Courses	
New Core	**Previous Core**
Optical wave Propagation	Optical wave Propagation
Interference, Diffraction and Coherence	Interference, Diffraction and Coherence
Fundamentals of Applied Optics	Radiometry and Detection
Fundamentals of Optical Science	Fourier Optics
Fundamentals of Photonics	Geometric Optics
	Optical Properties of Materials
	Electro Optics
	Laser Engineering

In an effort to streamline the PhD process, in 2002, the Optics PhD core was changed considerably. The goal was to allow students to take the crucial PhD qualifying examination earlier, yet still maintain a broad and thorough core curriculum in Optics. The courses developed for the new core are shown in Table 1, along with the previous core. While the new core is shorter, it should be noted that all the important elements of the previous core are included in the new core courses. Additionally, the overall optics course requirement of the PhD remained at a minimum of 30 semester credit hours, so that graduates emerge from the new system with no less training in optics. Core courses are taught twice per year to keep class

sizes small and accommodate students who arrive in the spring. The net result of this has been to allow top students to more rapidly commence their PhD dissertation work, while still providing a thorough optics core and a challenging PhD qualifying exam. The added benefit is that those who do not pass the qualifying exam are usually able to graduate with the MS degree in less than 2 years since enrolling.

3. Usefulness of Admissions Criteria

Approximately 50% of our students are international and additionally, graduate optics students come from diverse academic backgrounds. Hence it is often difficult to find accurate means of assessing applicants to our graduate program. Traditionally, reliance is placed on GRE scores, in particular, the GRE "Quantitative" (Q) score. It is therefore of interest to us to examine how well this score predicts performance in our program. Our results in this respect are mixed. In Table 2, we show the average, minimum and maximum quantitative scores for students who passed the qualifying exam at the 1st attempt, at the 2nd attempt, and for those who ultimately failed. We also show the mean core grade point average (GPA) for students in each category. The mean scores indicate a clear correlation between the Q score and success in our program, but the max and min Q scores indicate the difficulty with using these scores as absolute admission criteria.

Table 2	**Mean GRE Q score**	**Max GRE Q score**	**Min GRE Q-score**	**GPA (4.0 scale)**
Passed Qual 1st time	752	800	620	3.7
Passed Qual 2nd time	722	800	640	3.4
Failed Qual Exam	714	790	620	3.1

Another measure of performance in the program is the time taken for a student to graduate. As seen in Fig. 3, those scoring over 760 show somewhat shorter times to graduate than those with lower scores. However, time-to-graduation is not a conclusive factor in determining quality. Overall, we can conclude that the GRE quantitative score is a useful parameter in determining an applicant's potential for success in the PhD program, but it cannot be used in isolation to reach an admission decision.

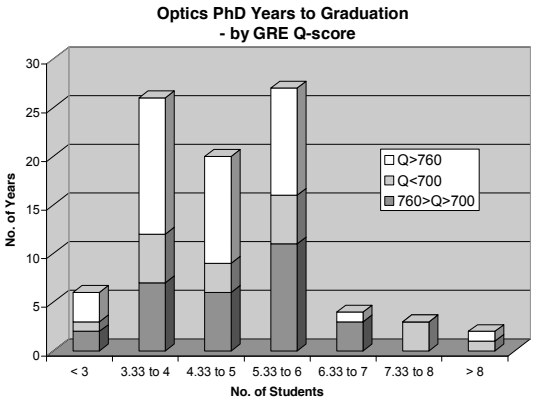

Figure 3. Chart of Time taken to graduate from PhD program for various GRE quantitative score ranges

4. Future Directions

In addition to our traditional graduate degrees, we are embarking on a new Photonics Track in the UCF Electrical Engineering (EE) MS program. This is aimed at EE students who have an interest in optics, but wish to pursue their graduate education in engineering. Currently, the College teaches undergraduate optics courses in UCF's Physics and EE undergraduate programs and the possibility of a Bachelors Degree in Optics is being explored.

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