PRACTICE ORIENTED GRADUATE PROGRAM IN OPTICAL ENGINEERING AND SCIENCES

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Abstract ¾ *The advent of optical fibers and lasers and their widespread use in communication has given a new direction to the information age in the form of optical fiber communications. The optical fiber technology is going to be the main technology of twenty first century and is going to affect every sphere of our lives. The rapid growth of internet is already an indication of this exciting future. For educational institutions it is necessary to train the students in this new technology and provide the manpower required to solve the complex problems imposed by the technology. In order to fulfill this need a new and interdisciplinary practice oriented graduate program (MS/Ph.D.) in optical engineering and sciences has been proposed. This paper discusses the need of such a program and basic outlines of the program. At the same time it focuses on the collaboration with the industries with complete approach and outcome.*

Index Terms ¾ Course structure, graduate program, optical technolgoy, practice oriented.

Introduction

The emerging optical fiber technology is playing the most important role in the present day information super highways. Few years back the optical fiber technology was actually slowing down due to higher cost compared to other communication technologies. But the rapid growth and expansion of internet has forced the fast development of optical fiber technology providing speed in the Gbit/s range. A decade ago such a high speed was just a dream and a few hundred Mbit/s was supposed to be quite high. In optical comunication the light carrier propagates in the extremely thin optical fiber with the advantages of very large information capacity, freedom from electromagnetic interference providing security and minimum possible losses. Due to all these advantages the optical fiber technology is going to be the main communication technology of twenty-first century. Besides communication, the optical fiber sensors area is becoming another important area. Once we have all these areas in full swing we are going to need large number of optical engineers and scientists. In order to meet this huge demand, it is extremely important that the educational institutions start offering graduate programs in this important area especially the practice oriented programs. The interdisciplinary nature of this technology requires proper cooperation among various departments in the universities. Similary the admisison requirements of ths program are to be quite different than the conventional disciplines.

Program Structure and Admission Requirements

Due to intense scientific nature and industrial applications, the graduate program has to be geared in these two directions. The beginning few semesters of the proposed graduate program are to focus on the basic core courses necessary for both the directions. The later semesters are to be devoted to the industrial design and scientific research aspects of the program. Accordingly the proposed course structure is as follows [1]:

Core Courses

EE 645 Optical Fiber Laboratory
EE 648 Fundamentals of Optical Fiber Communications
EE 748 Optoelectronic Devices and Materials
PHYS 723 Applied Optics
PHYS 725 Laser Physics

Elective Courses-Optical Engineering

EE 741 Optical Fiber Communications
EE 742 Optical Fiber Sensors and Applications
EE 743 Optical Fiber Networking
EE 744 Design of Optical Components and Systems
EE 746 Optical Imaging and Signal Processing
EE 747 Integrated Optics
EE 790 Seminar
EE 791 Special Topics
EE 792 Special Problems
EE 793 Independent Study
EE 794 Practical Training
EE 797 Thesis
EE 799 Dissertation

Elective Courses- Optical Science

PHYS 712 Electromagnetic Theory
PHYS 721 Quantum Theory
PHYS 724 Quantum Optics
PHYS 726 Laser Interaction with Matter
PHYS 790 Seminar

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PHYS 792 Special Problems
PHYS 794 Practial Training
PHYS 797 Thesis
PHYS 799 Dissertation

The above program structure and course numbering is based on the University of Nevada, Reno Catalog and the joint program between Electrical Engineering and Physics Departments. It should be modified according to the university adpoting this program and various departments involved with the program. All these courses are 3 credit courses except EE 645 which is one credit lab, thesis is for 6 credits and dissertation is for 24 credtis. The core courses and the practical training course are to be taken by all the graduate students. Total credits required are 34 and 52 for M.S and Ph.D. (after M.S.) programs, respectively. If the students are admitted into the Ph.D. program after B.S., the credits required are 78. All these credtis include 6 credits of thesis for MS students and 24 credits of dissertation for Ph.D. students. The time period required for 3 credits of practical training is one semester plus summer term. Thus the time required to complete the program may be more than the normal graduate programs. The practical training part is very valuable part of the whole program which enhances the employment opportunities for these students.

For admission into the MS program the applicant must have completed a BS degree with a major in EE, physics, engineering physics, optics, applied mathematics, chemistry, chemical engineering, material science, or other appropriate disciplines with a minimum GPA of 3.00/4.00. Similarly for admisison into the Ph.D. program, the student must have completed a master's degree with a major in any of the above mentioned disciplines or other appropriate disciplines with a minimum GPA of 3.50/4.00 in the graduae program. At the same time the students with BS degree directly applying for Ph.D. program should have a minimum GPA of 3.50/4.00. A minimum GRE score of 2000 is nominally required. For international students whose native language is not English, the TOEFL score of 560 is required. Prerequisite courses are required for the students with BS and /or MS degree in the fields other than the EE, physics, engineering physics or optics. At the same time the EE students opting for Opcical Science program or vise versa may be required to complete some prerequisite courses. The prerequisite courses are to be determined by the program director in consultation with the student's advisor on a case by case basis.

Practical Training – Approach and Outcome

As already mentioned that the practical training is an integral and very important part of this graduate program. The students are eligible to apply for practical training after 12 credit course work. The training can be completed either in continuation of summer with any semester or separately. The program director or his appointee faculty would serve as the coordinator for the training program. The student's interest and thesis/dissertation areas are the main considerations for training placement. The trainining ceneters would include optical industries, DoD research laboratories, DOE laboratories, NASA centers and some universities with appropriate research facilities and industrial projects. Every student has to submit an outline and abstract of the project before leaving for training. It is to be made sure that the students are appropriately paid during the training period. Many of these industries and research centers would be requested to provide fellowships etc. to the students during other semesters also. During training period the program director would visit all the training centers to keep track of the progress of the students in their respective projects. At the end of the training every student has to submit a detailed report to receive suitable credits. The main advantage of this training program is to provide practical world exposure to the students. At the same time it may facilitate in their employment after graduation if agreeable to both the parties. It is possible that this decision may be taken before they actually graduate from the university. Actually this type of approach can be used by any engineering program in the universities. The main advantage to the universities is that they would be able to build good working relationships with industries and research laboratories. Besides, they are able to train students in different areas for which it is not possible to creat reseach facilities on the campus.

On the paper this approach sounds very good and attractive also. But in the real world the success of this approach depends on various factors like availability of funding with collaborating industries and research laboratories, appropriate projects suitable for theses or dissertations, market economy, visa status of the international students in the program, coordination of time and required course work completion by the students etc..

Conclusion

The outline of a practice oriented graduate program in optical engineerng and sciences have been presented. The program structure, courses and admission requirements presented can be easily modified according to the various departments involved in the interdisciplinary program and the basic rquirements of the university following this approach.

References

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