


New Program Planning Summary

CLEMSON UNIVERSITY
REQUESTING TO OFFER A NEW PROGRAM
MASTERS OF SCIENCE
AND
DOCTOR OF PHILOSOPHY
IN
PHOTONICS

Submitted to the South Carolina Commission on Higher Education

College of Engineering and Science
Clemson University

May 1, 2008



James F. Barker, FAIA
President
Clemson University

PROGRAM PLANNING SUMMARY

New Graduate Program: MS and PhD in Photonics

Proposed Date of Implementation: September 2009

Justification of need for the proposed program:

This proposal requests approval to establish a new interdisciplinary graduate program that offers Master of Science in Photonics and PhD in Photonics hosted by the Center for Optical Materials Science & Engineering Technologies (COMSET), which is a research unit of the College of Engineering and Science. The program will prepare students with the fundamental science and engineering of light and specific interactions targeted for basic understanding and applications relevant to their home academic department(s) research areas and collaborative co-advised graduate committees. Graduates from this program will possess the multi-disciplinary and global multi-cultural team skills needed for Masters and PhD level professionals in photonic materials development, nano- and micro-photonics device integration, fabrication, optical sensing, biophotonics, energy conversion, displays and telecommunications. Clemson's photonics professionals will be equipped to lead innovative global and diverse teams which will enable future generation products, new industries, and knowledge based on light not yet conceived.

Founded on April 12, 2000, The Center for Optical Materials Science and Engineering Technologies (COMSET) is an interdisciplinary research unit of the College of Engineering and Science at Clemson University. COMSET provides an organized framework with significant centralized infrastructure for faculty having common interests to collaborate in developing advanced materials that exhibit a value-added interaction with light. COMSET's vision is to be the recognized global leader for innovation and education in the science and technology of optical materials.

The science and engineering of light-based technologies is presently a ~ \$300 billion global market opportunity that is growing at double digit rates towards a projected \$1 trillion market by 2015. The Southeastern United States, and in particular, the Atlanta-Charlotte corridor already contains a large (> 200) concentration of the companies operating across multiple markets within the optics and photonics industry. With materials as the technology enabler within all devices and components, Clemson University and South Carolina, through COMSET, are uniquely positioned to support the research, educational, and out-reach needs of the industry.

COMSET's current 17 faculty members are tenured and promoted within their home CES departments and schools including: Bioengineering, Chemistry, Chemical and Biomolecular Engineering, Electrical and Computer Engineering, Material Science & Engineering, and Physics. Since 2000, COMSET has generated over 250

publications that have been cited over 1,100 times [Web of Science] and has an h-index of 16. This level of scholarship averages 2.8 publications and 13 citations per month. To date, sponsored research exceeds \$38,000,000. COMSET research productivity provides a tremendous impetus for a formalized pedagogy to ensure that our current and future photonics based graduates are prepared the best they can be in order to compete in this growing field.

In 2004, COMSET was approved by the Commission on Higher Education as the only optics program in South Carolina. Also in 2004, COMSET was selected as a South Carolina Research Center of Economic Excellence. Additionally, COMSET has demonstrated success in incubating entrepreneurship and the Center has spun out two companies: Advanced Photonic Crystals (Fort Mill, SC) and Tetramer Technologies (Pendleton, SC). These companies alone provide excellent testimony for the need for photonics specialists and the opportunity for further Clemson contributions to South Carolina's knowledge based economy.

COMSET has been a founding member in a regional optics cluster, which has been identified as one of only 5 such academic clusters in the United States. This includes the *Carolina MicroOptics Triangle (CMOT)*, which brings together research and economic development between Clemson, UNC-Charlotte and Western Carolina University. *The Carolinas Photonics Consortium (CPC)* was created in 2007 and partners CMOT with Duke University and NC State University. Additionally, in 2005, Clemson and Furman entered into a formal partnership establishing the *Charles H. Townes Optical Sciences and Engineering* program. Dr. Townes is an alumnus of Furman (1935), honorary degree recipient from Clemson (1963) and Nobel Laureate (Physics, 1964) for the invention of the maser/laser. These partnerships and others will no doubt continue to grow and thus provide both the feeder institutions for our photonics graduate students as well as technical cluster communities needing to hire Clemson's photonics professionals.

Anticipated Program Demand and Productivity

The initial class is expected to consist of about 24 students. In the second year and beyond, we expect to enroll 25-30 new students with the goal of 4-6 graduates per year in year 6. It is expected that that most of the students will be full-time. COMSET graduate fellowships will be available.

Assessment of the Extent to Which the Proposed Program Duplicates Existing Programs in the State

The proposed program does not duplicate existing programs in the State. At this time Clemson is the only institution that has focused research in optics with an Endowed Chair and CHE approved center.

Relationship of the Proposed Program to Other Related Programs within the Institution and Consistency with the Mission of the University

Proposed here is the creation of an academic program to support the existing research program of COMSET. As COMSET is the only CHE-approved optics-related

program in South Carolina, there is no overlap, competition, or redundancy with any other State program.

The program is consistent with both the university and college missions. It further supports the University's roadmap for academic excellence that identifies "niche areas" within the college that enable unique and value added growth. In addition, this program spans several major emphasis areas including: Advanced Materials, Communications, Leadership, and Sustainable Environment.

Relationship of the Proposed Program to Other Institutions via Inter-Institutional Cooperation

There are currently over 30 graduate programs in "Photonics" worldwide with only 1 in the United States. The single US photonics program is offered by Oklahoma State University and has recently lost its most significant faculty champion and has experienced decreased productivity. Clearly, the United States is behind the rest of the world in providing access to training in this strategically important field to our defense and communications industries, just to mention two. Other relations with universities are described in detail in the Justification section of this document.

Total New Costs

COMSET's current 17 faculty members are tenured and promoted within their home CES departments and schools including: Bioengineering, Chemistry, Chemical and Biomolecular Engineering, Electrical and Computer Engineering, Material Science & Engineering, and Physics. Anticipated new costs include an optics lab for graduate students, but no new faculty is anticipated and grant funding is available to support graduate students.