

**New Program Proposal
Master of Science
Doctor of Philosophy
Photonic Science and Technology
Clemson University**

Summary

Clemson University requests approval to offer a new program leading to the Master of Science and the Doctor of Philosophy in Photonic Science and Technology to be implemented in Fall 2010. The proposed program is to be offered through blended instruction methods on the Clemson campus and at the Clemson Research Park Advanced Materials Research Laboratory in Anderson County.

The Program Planning Summary was submitted to the Commission in May 2008 and reviewed and voted upon favorably without substantive comment by the Advisory Committee on Academic Programs on July 17, 2008. The Clemson University Board of Trustees approved this proposal on April 18, 2008. The full proposal was received by the Commission on November 15, 2009.

According to the proposal, the purpose of the proposed program is “to establish the first interdisciplinary Photonics graduate program in South Carolina and the second only in the United States.” The proposed interdisciplinary program will be closely affiliated with Clemson’s Center for Optical Materials Science & Engineering Technologies (COMSET), which is a unit of the College of Engineering and Sciences, as well as with the Optical Materials Center of Economic Excellence. The proposal states that the proposed degree supports four of eight academic emphasis areas found in Clemson University’s mission statement: advanced materials, communication and information technologies, leadership and entrepreneurship, and sustainable environment.

The proposal indicates that light-based technologies are presently a \$400 billion global market with projections of \$1 trillion by 2015. While the proposal notes that there are more than 30 international academic programs in photonic science, Oklahoma State University is presently the only U.S. institution to offer a doctorate in Photonic Science. The proposal also states that the Atlanta-Charlotte corridor is an important region for the light-based technologies industry, with more than 200 light-based technologies companies. No fewer than 50 professional positions in this industry exist in the Clemson area; these positions have resulted from start-up companies associated with COMSET and Centers of Economic Excellence (CoEE) Program research.

The U.S. Bureau of Labor Statistics (BLS) projects nearly 180,000 new engineering positions between 2008 and 2018, with total national engineering positions increasing to nearly 1.75 million. However, according to staff research, BLS projects non-computer electronics engineers “are expected to experience little to no employment change over the projections decade.” Employment opportunities for non-computer electronics engineers are expected to remain near or at 144,000 between 2008 and 2018. Also, BLS projects a modest increase of 2,000 materials engineering employment opportunities between 2008 and 2018.

Should the proposal be approved, Clemson University would be the only South Carolina institution to offer any photonic science-related degrees. The proposal states that the proposed

programs will not be subject to specialized or professional accreditation, nor would students be subject to additional professional certification.

The proposed doctoral program will consist of 48 credit hours of course work, which includes a core curriculum of 9-13 credit hours, 4-8 hours of photonic science and technology seminar course work, and 9 elective credits hours in either business, ethics, cooperative education, or industrial internships. In addition, the proposed doctoral program includes 18 hours of dissertation research, plus successful dissertation defense. The proposed doctoral program includes two new courses to be offered at Clemson University, the photonic science and technology seminar course and the dissertation research course. All other proposed program courses are currently offered by the Department of Physics and Astronomy, the Department of Chemistry, the School of Materials Science and Engineering, and the Holcombe Department of Electrical and Computer Engineering.

The proposed doctoral program will contain a “stop-out” Master’s of Science in Photonic Science and Technology. This degree will only be conferred upon a graduate student who completes the entire program of coursework for the Ph.D. program but for personal reasons is unable to complete or finish dissertation work.

A thorough and positive external evaluation of the proposed program was submitted on November 18, 2009, by Dr. Richard A. Haber of the Center for Ceramic Research at Rutgers University. In his evaluation, Dr. Haber endorses the proposed program: “I find the proposed curriculum well-balanced and appropriate in scope for photonics science and technology. ... If approved, COMSET and the State of South Carolina will be noticed as a leader in photonics education in addition to your continued recognition as a center of excellence in photonics research.”

According to the proposal, admissions requirements for the proposed doctoral program include an undergraduate degree “from an accredited college or university in a recognized relevant science or engineering discipline.” Additionally, “prerequisite undergraduate courses may be required for applicants with undergraduate degrees in non-engineering or nonscientific disciplines.” Students will apply to the proposed program through the Clemson University Graduate School and will be assigned a home academic department; the Graduate School Director will serve as co-advisor until a student’s graduate committee has been finalized. Acceptance to the proposed doctoral degree will be determined by faculty reviews of a student’s previous degree work and GRE scores.

The proposal anticipates there will be four new students (4 FTE) in the program’s first year, increasing by five additional students (5.5 FTE) in the second year, seven in the third year (8.5 FTE), and ten in the fourth and fifth years (11.5 FTE each year). If enrollment and program completion projections are met, the proposed program will meet the Commission’s productivity standards.

The proposal indicates that the proposed program will not result in the addition of new faculty members. The proposal lists as currently on staff and additionally available to support the program four professors (fields of study are Optical Inorganic Materials, Optical Organic Materials, Fiber Optics, and Spectroscopy), two associate professors (fields of study are Optics and Microelectronic Processing), and one assistant professor (field of study is Chemistry of Optical Materials). Total FTE faculty devoted to the proposed program will be 1.75 FTE in both the first and second years, 2 FTE in the third year, 2.25 FTE in the fourth year, and 2.5 FTE in the fifth year.

New costs for the program are estimated to begin at \$26,000 the first year and include one graduate assistantship (\$20,000), supplies (\$1,000), and office and laboratory equipment (\$5,000). Estimated new costs increase to \$28,000 the second year and include one graduate assistantship (\$21,000), supplies (\$1,000), and office and laboratory equipment (\$6,000). Estimated new costs increase to \$31,300 in the third year and include one graduate assistantship (\$22,300), supplies (\$2,000), and office and laboratory equipment (\$7,000). Estimated new costs increase to \$33,500 in the fourth year and include one graduate assistantship (\$23,500), supplies (\$2,000), and office and laboratory equipment (\$8,000). Estimated new costs increase to \$36,000 in the fifth year and include one graduate assistantship (\$25,000), supplies (\$2,000), and office and laboratory equipment (\$9,000). The total estimated new costs for the program for its first five years total \$154,800, which includes \$111,800 for graduate assistantships, \$8,000 for supplies, and \$35,000 for office and laboratory equipment.

The proposal indicates no extraordinary costs for the proposed program. COMSET faculty currently work at the Clemson Research Park Advanced Materials Research Laboratory in Anderson County, a new state-of-the-art research facility developed through the South Carolina Research University Infrastructure Act. The proposal also states that no new library resources are needed to maintain the proposed program.

Below are the estimated Mission Resource Requirement (MRR) costs to the state and new costs not funded by the MRR associated with the implementation of the proposed program during its first five years. Also shown are the estimated revenues projected under the MRR and the Resource Allocation Plan as well as student tuition.

Estimated Program Costs and Revenue

| | Estimated Program Costs | | Estimated Program Revenue | | | | (G) Total Revenue - Total Costs (F-(A+B)) |
|---------------|-------------------------|---------------------|-----------------------------|----------------|---------------------------|------------------------------|--|
| | (A) MRR Cost | (B) Other Costs* | (C) Actual State Funding | (D) Tuition | (E) Additional Revenue | (F) Total Revenue (C+D+E) | |
| Year 1 | \$89,364 | \$0 | N/A | \$30,464 | \$0 | \$30,464 | -\$58,900 |
| Year 2 | \$122,876 | \$0 | \$59,767 | \$42,074 | \$0 | \$101,841 | -\$21,035 |
| Year 3 | \$189,899 | \$0 | \$81,786 | \$65,294 | \$0 | \$147,080 | -\$42,819 |
| Year 4 | \$256,922 | \$0 | \$125,825 | \$88,514 | \$0 | \$214,339 | -\$42,583 |
| Year 5 | \$256,922 | \$0 | \$169,863 | \$88,514 | \$0 | \$258,377 | \$1,456 |

*Includes costs of an extraordinary nature not otherwise included in the MRR cost calculation (e.g., costs for a new building required to support a program).

These data show that if Clemson University can meet the projected student enrollments and contain costs as shown in the proposal, the proposed program will cover costs with revenues it generates beginning in the fifth year of implementation.

In summary, Clemson University is proposing a program leading to the Doctor of Philosophy in Photonic Science and Technology. Designed as the state's first and the nation's second terminal degree in the science of light-based technologies, the proposed interdisciplinary program will prepare students to support the research, educational, and outreach needs of the optical materials science industry, with an emphasis on advanced training in optical polymers, glass, and crystal engineering. The proposed master's degree will be used only as a "stop-out" degree for students unable to complete the doctorate. Students will not be admitted directly into the master's degree.

Recommendation

The staff recommends that the Committee on Academic Affairs and Licensing commend favorably to the Commission approval of the programs leading to a Master's degree as a "stop-out" degree and a Doctor of Philosophy degree in Photonic Science and Technology at Clemson University, to be implemented in Fall 2010 and offered on the Clemson campus and at the Clemson Research Park Advanced Materials Research Laboratory in Anderson County, provided that no "unique cost" or other special state funding be required or requested.