

## A New Joint Electrical Engineering Program

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### Abstract:

Regional economic development is a key focus for Federal and state legislators as well as the General Administration of the University of North Carolina (UNC) system. Western Carolina University (WCU) and UNC-Charlotte, both constituent universities of the UNC system, are responding to this challenge by creating a joint electrical engineering program in Western North Carolina. The two universities are already linked through grant activity in the Carolinas Micro Optics Triangle. The new program will have an emphasis on optical communications and photonics. Graduates are expected to be the process and test engineers for the photonics industry.

### Introduction:

The University of North Carolina at Charlotte (UNC-Charlotte) has a strong Electrical and Computer Engineering (ECE) Department, with close ties to the Department of Physics and Optical Sciences. Western Carolina University (WCU) has a Department of Engineering Technology with programs in Electrical and Computer Engineering Technology (ECET) and Telecommunications Engineering Technology. To reflect the addition of the new engineering program, the Department will now become Engineering and Technology. A Director from each University will jointly administer the program. The initial task is to replicate the UNC-Charlotte program at WCU, with the upper level electives being new courses focused on photonics. The syllabi, texts, assessment goals and objectives will be patterned on those from UNC-Charlotte, while the students will be at WCU.

Course delivery methods will include distance techniques, visiting professors, and coordinated lectures by faculty from both Universities. Joint faculty must meet the required credentials for both Universities. All labs will be performed at WCU using existing facilities. At least one course per semester will be taught by WCU faculty to maintain contact with the students and to aid retention. WCU will continuously add qualified faculty as the program progresses, to carry an appropriate share of the teaching load.

A Memo of Understanding has been drafted to cover issues such as transcripts, admissions criteria, evaluation of transfer students, library usage, assessment methods and structure, freshman engineering courses, and student fees. This document calls for yearly reviews by the Directors to ensure continuity. The long-term goal is to have this program separately accredited. Freshmen are to start this program in fall of 2004.

### Need for Program:

Western North Carolina is geographically remote from the highly developed urban areas of North Carolina and the neighboring states. The traditional large employers have been furniture and textile industries, with tourism being a dominant source of revenue and employment. For generations, young people have had to leave the region to receive engineering educations. This has not only been a “brain drain” but has also weakened the technical infrastructure, so that potential new industries are not attracted to the region. With the demise of the textile and furniture industries, a concerted regional effort is underway to attract and retain business, and to compete in the greater markets.

AdvantageWest-North Carolina is western North Carolina's regional economic development commission. In 2000, this agency commissioned a report which stated that WCU is a significant factor in the economic development for the region<sup>1</sup>. WCU is the regional comprehensive University serving the 27 westernmost counties of North Carolina. One key priority identified was the need for an engineering program at Western<sup>2</sup>. Such a program would provide local engineers for local industries in the short term. In the longer term, the increased technical base would foster innovation and the creation of new businesses. This model has been very successful in the Research Triangle Park near Raleigh, and has been the model adopted by the city of Charlotte.

The Board of Governors for the UNC System studied this model during 2002 and 2003, and in their Engineering Report<sup>3</sup> approved in March 2003 they advocated joint programs to facilitate the cost effective creation of new programs. In addition, the Board of Governors next approved a process for joint programs<sup>4</sup>.

### Program Description:

Western Carolina University and The University of North Carolina at Charlotte will offer a joint Bachelor of Science degree in Electrical Engineering (BSEE). The degree program will follow the UNC Charlotte electrical engineering curriculum, which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC/ABET)<sup>5</sup>. WCU and UNC Charlotte will later seek accreditation from ABET for the joint program.

For purposes of program administration, the Dean of Engineering at UNC Charlotte and the Dean of the College of Applied Sciences at WCU or a designee of the Chief Academic Officer at each institution will be responsible for each appointing a campus director for the joint program. The directors will be responsible for the program operation and accreditation. The constituent faculties of the Joint Program at WCU and UNC Charlotte will hold adjunct rank at the collaborating institution. Program directors, in consultation with their appropriate deans, will appoint a minimum of three faculty members at their respective institutions to serve as a Joint Faculty Curriculum Committee (JFCC). The JFCC will have responsibility for recommending to the Joint Program Faculty curriculum modifications, program objectives and outcomes, admission standards, assessment methodology and standards for student progression and graduation.

Selected EE courses will be delivered by both WCU and UNC Charlotte faculty using distance delivery systems supported by online technology to students on the two campuses. Other selected EE courses will be taught on-site by WCU faculty. Remote sites will support students with on-site supplemental instruction by qualified content experts approved by the Program Directors. Each institution will support the program with qualified technical staff. Liberal studies (general education), mathematics, and sciences courses will be taught on-site by WCU faculty using existing courses.

The following example is taken from the sophomore year. The table of course offerings for that year is below:

EE 201 Network Theory I	(3)	EE 202 Network Theory II	(3)
EE 200 Comp. Util. in C++	(3)	EE 222 El. Eng. Design I	(2)
EE 221 Logic System Design. I	(3)	EE 212 Instrumentation/Networks Lab	(1)
EE 211 Logic/Networks Lab	(1)	Oral Communications (C3)	(3)
MATH 253 Eng. Calc. III	(3)	MATH 320 Ord. Diff. Equations	(3)
PHY 231 Physics II	<u>(3)</u>	PHY 310 Modern Physics	<u>(3)</u>
	16		15

WCU will initially assume responsibility for the two network analysis courses (EE 201 and EE 202) as well as the Laboratory courses (EE 211 and EE 212). To complete the offerings, UNC-Charlotte will be responsible for the Digital logic course (EE 221) and the Engineering Design course (EE 222). In this manner, the students will have access to both faculties. The students residing at WCU will have access outside of class hours to the labs and to mentors for all courses.

Admission standards to the program shall be determined by the Joint Faculty and implemented by an admissions committee at each campus. Program admission requirements will be those used by the UNC Charlotte Engineering Program at the point the program is implemented. Students admitted to the joint program will have a designated home institution, usually the institution at which general education requirements are completed. Joint program students are eligible to enroll in program courses offered at either institution and are eligible to enroll in other courses on a space available basis. The primary audience of the Joint Program will be students who enroll at WCU as freshmen. Students who wish to major in EE will be enrolled in the Freshman Engineering Program. Upon successful completion of this program and satisfaction of the progression requirements, they will be transferred to the EE program. The program will also accommodate graduates of Associate in Science college transfer programs. Students from two year Associate in Applied Science programs, who wish to transfer to EE, will have to fulfill necessary prerequisites, e.g., mathematics and sciences. In order to enter the EE program, all students regardless of their previous academic background must complete successfully the Freshman Engineering Program.

#### Resources:

Faculty from the Department of Electrical and Computer Engineering at UNC Charlotte and the Department of Engineering and Technology at WCU will form a Joint Faculty for the Joint Program in Electrical Engineering. The Joint Faculty will include all qualified faculty members from each institution.

As entering freshman enrollment increases, additional lecture and laboratory sections will be necessary. It is anticipated that additional faculty will be hired to maintain the ongoing joint program. The joint faculty will participate in the recruitment and hiring for any new faculty for the joint program, ensuring they are EAC/ABET qualified.

The Department of Engineering and Technology at WCU maintains 14 laboratories for instruction. Five of these laboratories are dedicated to electrical and telecommunications engineering technology. All are equipped with modern computers for simulation exercises. Other laboratories are used for engineering computing graphics, rapid prototyping, manufacturing automation, machining, and metrology. A new building, the Center for Applied Technology, was dedicated in November 2003, and will provide four of the 14 laboratories with approximately 15,000 square feet and two additional classrooms.

The Department received an award (\$4.7 million dollars) which is being administered by the Defense Advanced Research Projects Agency (DARPA). Approximately seventy percent of this award is being allocated to the acquisition of new equipment and infrastructure items to up-date existing electrical laboratory space and technology. New instrumentation and computers (including engineering workstations) have been purchased that will improve testing capabilities and provide for the integration of computer-based testing and measurement.

Two new laboratories are being created for photonics and optoelectronics using DARPA resources. Equipment is being specified that will provide for undergraduate experiences with fiber optics, optical communication, and optical sources and detectors. Additional equipment is being purchased to support research on optical transceiver transmission rates and related bit error ratio testing. The technical electives in the EE program will focus on the area of optoelectronics.

Students enrolled in the joint degree program will have access to the collections and services of both the Hunter Library at WCU and the Atkins Library at UNC Charlotte. Interlibrary loan agreements already exist within the UNC System. The electronic library products will require a review of existing license agreements. The impact in student fees will be handled through the Memo of Understanding.

WCU is remodeling and developing an additional distance education facility. UNC Charlotte is adding equipment to outfit two classrooms in the Science and Technology Building for distance education delivery including computers, cameras, projectors, sound system, and associated equipment. Both institutions will require coordinating software licenses and additional full-time technical support personnel.

#### Memo of Understanding:

In order to create joint programs, the UNC Board of Governors outlined several processes that need to be defined between the partner Universities. The following processes must have been certified for the joint degree program:

- a. Admission process
- b. Registration and enrollment process for students

- c. Plan for charging and distributing tuition and fees
- d. Management of transcripts and permanent records
- e. Participation in graduation
- f. Design of diploma

A Memorandum of Understanding between the two universities details the operational aspects of the joint degree program. The memorandum addresses the six processes listed above, and the mechanisms for changes to the program and its administration.

The two institutions will develop a plan to address tuition and fees that will minimize any differential that might exist between a student enrolled full time in this joint program through a combination of WCU and UNC Charlotte courses and the cost for a student to be enrolled full time at the home institution. The student's tuition and fees will be a combination of tuition for courses at the home institution and the corresponding distance education tuition for courses taught remotely. Jointly enrolled part time students (resident credit or distance education credit) will pay tuition and fees to the applicable institution granting the academic credit.

#### Program Acceptance Criteria:

Applicants to the joint electrical engineering program will meet the general admission requirements of their home institution. WCU and UNC Charlotte are open to all qualified students without regard to race, sex, color, national origin, religion, age, sexual orientation, or disability. The details for each University are posted online<sup>6,7</sup>. Applicants to the electrical engineering program at WCU will adhere to the same guidelines as established for these majors at UNC Charlotte. Admissions to the joint program will be determined by the joint faculty committee or an admissions committee designated by the joint faculty.

*Freshman* admission is competitive. Based upon an overall evaluation of high school records with particular emphasis on advanced courses in math and science and test scores, freshmen may be admitted directly to the Freshman Engineering Program. *Transfers* must present a GPA of at least 2.50 and meet the same mathematics requirements as engineering freshmen using either high school or college mathematics courses. All transfers will be admitted to the lower division of the electrical engineering program, and evaluation of transfer credits to the program will be performed by the Registrar and the Department Head. Transfers from an ABET accredited engineering program who do not have a 2.50 GPA may be admitted upon the recommendation of the Department Head.

All students making application to the electrical engineering program must take a mathematics placement examination to determine the appropriate entry-level mathematics course.

*Freshman Engineering (FENG)* is an individualized advising program for all entering students who intend to major in electrical engineering. Upon successful completion of this first year, the student is transferred to the EE major.

*Freshman Year Requirements.* All new freshman students are initially advised by a faculty associate in the Department of Engineering and Technology. Students are eligible to transfer to the electrical engineering major upon 1) completion of all non-elective courses in their freshman

year curriculum with grades of C or better, and 2) a minimum cumulative grade point average (GPA) of 2.00 for all courses taken.

*Sophomore through Senior Year Requirements.* In addition to the home University's requirements for continued enrollment, students must maintain a cumulative GPA in the major of 2.00 for all courses taken within the program. A student is suspended from the electrical engineering program when the student fails to achieve good standing by the end of two successive semesters on probation (excluding summer sessions).

Students admitted to the joint program will have a designated home institution, usually the institution at which the general education requirements are completed. The institutions will cooperate to maintain registration and enrollment records for students in the joint program. Transcripts will be maintained at the home institution for each student. The registrars from both institutions will develop registration and record keeping systems for the joint program that appear seamless to the students.

Students in the joint program must adhere to all progression and graduation requirements for their home institution as well as those of the joint program. They are also subject to all policies and standards of the institutions in which they are enrolled. Grievance issues will be handled by the institution responsible for the course delivery.

Each student who will receive a joint degree must be approved by the institutional process for certifying a student to receive a degree by each UNC institution whose name will appear on the diploma. These diplomas will carry the seals for both Universities and the signatures of the appropriate administrative officers.

#### Summary:

This program will be known as the WCU-UNC Charlotte Joint Program in Electrical Engineering, and will be governed by a joint faculty drawn from both Universities. Directors from each campus are responsible for the program operation, and will coordinate the activities of a joint faculty curriculum committee. This committee will oversee the curriculum, program objectives and outcomes, admissions standards, assessment methodology, and standards for student progression and graduation. Changes must be approved through existing faculty governance procedures at each university. Accreditation by EAC of ABET will be the primary assessment strategy, and both institutions are committed to program excellence and student success.

#### Acknowledgements:

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<sup>4</sup> The University of North Carolina. (2003, April 11). *Appendices for the minutes on April 11, 2003*. Retrieved January 13, 2004, from <http://www.northcarolina.edu/content.php/bog/minutes/2003/AppendixB4.htm>

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## BIOGRAPHIES:

KENNETH BURBANK is an Associate Professor and Director of Electrical and Computer Engineering Technology at Western Carolina University. Dr. Burbank is active with IEEE, SME, and TAC of ABET, and strives to bring practical engineering activities into the classroom. His current project is the development of a photonics program within the joint EE curriculum.

GEORGE W. DESAIN is a Professor of Electrical and Computer Engineering Technology at Western Carolina University. He has a leadership role in the design and implementation of the new electrical engineering program and is developing an assessment plan coordinated with this joint program.

FARID M. TRANJAN is a Professor of Electrical Engineering in the William States Lee College of Engineering at the University of North Carolina at Charlotte. He has served as Department Chairman since 1992 and has recently led his department's reaccreditation efforts for both Electrical and Computer Engineering.