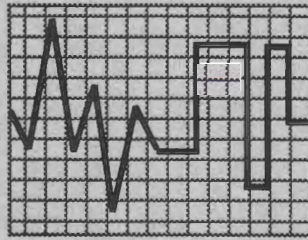
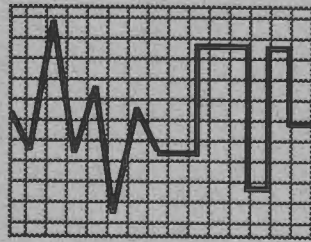


ANNUAL REPORT 1993-94



**ELECTRICAL &
COMPUTER
ENGINEERING**

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COMPUTER
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ACADEMIC YEAR 1993/94 ANNUAL REPORT
Department of Electrical and Computer Engineering
NORTH CAROLINA STATE UNIVERSITY

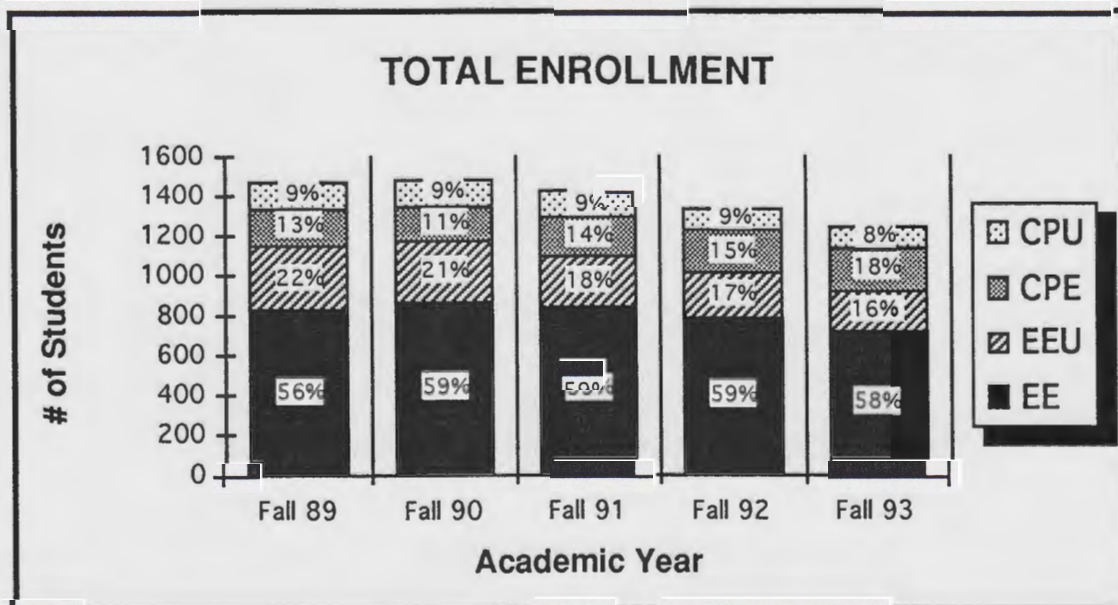
I. Changes in the Service Environment

Significant changes are underway in the funding mechanisms of various federal agencies for research grants and contracts. The implementation of Schedule 21 will have dramatic effects on the research environment within the department. Federal funding agencies have mandated the cessation of activities which they regard as overhead. Many of the services and costs that have been borne by research accounts will either disappear or become an overhead burden. Without a significant increase in overhead returns to the department (or to individual faculty) our ability to compete for new programs as well as to conduct existing programs will be adversely affected.

For example, the Army Research Office limits travel to \$1,500.00 per year per Principle Investigator. The Federal Highways Association does not allow conference travel. Travel for faculty enrichment and for program development is regarded as a university responsibility. These new policies may inhibit the development of interdisciplinary programs and the initiation of faculty work in new areas. These changes are far-reaching and impact allowable charges for personnel support and allowable material support charges for the research contract.

At the beginning of AY 1993/94, the ECE Department experienced another budget reduction. Funds allocated to the department operating budget were reduced about ten percent. In addition, after gaining an increase in indirect cost returns to the department, a ten percent return of these funds was mandated. The department has attempted to minimize the impact on programs by tightly controlling expenditures for staff support and for operations.

Enrollments in ECE appear to be declining. The chart below shows a five year history of the undergraduate student enrollment in the ECE department. (EEU and CPU denote freshmen who have declared a preference for Electrical Engineering and Computer Engineering respectively but who have not matriculated into the department.) A total decline of about 200 students is indicated by the chart data over the past five academic years. This trend may be a reflection of the dramatic declines in the numbers of high school graduates in North Carolina over the same period, it may reflect the somewhat higher standards imposed by the department for matriculation, or it could indicate a need for a more aggressive recruiting program.



II. Faculty

A. Honors

ECE faculty have continued to receive recognition for their contributions to the profession and to the programs of the department. Specifically:

- Dr. B. Jayant Baliga, who was recently elected to the National Academy of Engineering, won the IEEE Morris N. Liebmann Memorial Award.
- Dr. Joel Trussell was elected a Fellow of the IEEE for his contributions to image and signal processing; also, he and his student Patrick Combettes won the 1993 Paper Award from the IEEE Signal Processing Society.
- Dr. Michael Littlejohn was elected as Fellow of the IEEE for his contributions to solid state electronics.
- Dr. Troy Nagle began his term as President of the IEEE in January 1994. (IEEE is the leading professional association in the electrotechnology field with an international membership exceeding 300,000.)
- Dr. Ben O'Neal was recognized as an NCSU Outstanding Teacher.
- Ms. Joan Larson again won the George C. Blessis Memorial Outstanding Adviser award for the College of Engineering.
- Dr. Ralph K. Cavin, III was recognized as an Outstanding Electrical Engineering Educator by the Eastern North Carolina Section of IEEE.
- Dr. Wes Snyder was recognized as an Outstanding Educator by the IEEE.
- Dr. John Hauser was named Distinguished Professor of Electronic Devices and Materials. The appointment recognized Dr. Hauser for his outstanding research accomplishments in solid-state research over some thirty years.
- Dr. Carl Osburn was elected a Fellow of the Electrochemical Society for leadership in electrochemical and solid-state science and technology.
- Dr. Jerry Iafrate of the Army Research Office and an Adjunct Faculty member in the department was elected as a Fellow of the IEEE.
- Dr. John Grainger published a revised edition of the classical text by Dr. William D. Stephenson, entitled *Power System Analysis*
- Drs. C.T. Gray, Wentai Liu, and R. K. Cavin, III published the research monograph entitled *Wavepipelining: Theory and CMOS Implementation*.
- Dr. Paul Franzon published a book entitled *Multichip Module Technologies and Alternatives*. He also received the National Science Foundation Young Investigator's Award.
- Dr. Ajay Dholakia, a recent Computer Engineering Graduate, published the research monograph entitled *Introduction to Convolutional Codes with Applications*.

B. Publications and other Professional Activities

ECE faculty were very active in a wide variety of professional activities. Many of the faculty served on various IEEE committees, assumed important roles in the organization of professional conferences, served as reviewers for funding organizations or for technical papers submitted to scholarly journals for publication, served as advisers for state and federal government or as consultants for industry. The faculty published 112 journal papers and gave 152 conference and workshop papers/presentations.

C. Minority Representation and Recruitment Efforts

There are three African American faculty members and two female faculty members in the department. Our efforts to increase the numbers of under-represented minorities have been

unsuccessful. At this writing, the department plans to allocate one or more of its vacated faculty positions for this purpose.

D. Faculty Transitions

The ECE Department has lost many faculty during Academic Year 1993-94, primarily due to retirements.

- Ms. Joan Larson retired on May 15, 1994 from her role as Undergraduate Adviser. Joan was extremely popular with all ECE students and always made their interests as her highest priority.
- Dr. Jim Shelly, who held the rank of Lecturer and who played an active role in the Computer Engineering Graduate Program, retired on December 31, 1993 after five and one-half years with the department. Jim served the department in many other ways including chairing the open house program and generating the summary analyses of student evaluations of faculty teaching.
- Dr. Anthony Vanderlugt, who specializes in the field of optical signal processing and who attained international recognition for his fundamental contributions to the field, retired on December 31, 1993. His recent textbook on optical signal processing represents a significant contribution to the base of educational materials in this area.
- Professor William Easter retired effective May 15, 1994 after serving the department for more than thirty years. Bill had returned to teaching in recent years after an eleven year stint as Associate Department Head and was successively appointed by Governor's Martin and Hunt to serve on the State Board of Examiners for Electrical Contractors. He was chair of the Board for several years.
- Dr. Glenn Edgington, who so ably served as Coordinator of Graduate Programs, retired effective May 15, 1994. Glenn managed the large and complex ECE Graduate Program in a thoroughly professional manner and with a strong commitment to excellence.
- Dr. Don Rhodes retired from the department on May 15, 1994 and simultaneously changed professions from Electrical Engineering to Musicology. On April 8, 1994, Don gave a career transition seminar describing the work that he has been doing in the area of Musicology and linkages to engineering.
- Dr. Robert Trew left the department on December 31, 1993 to accept a chaired professorship and the chairmanship of the Department of Electrical Engineering at Case Western Reserve University. The department will miss the leadership that Bob provided in the area of microwave devices and systems.

During the Promotion and Tenure process, three faculty members were promoted to the rank of Associate Professor with tenure.

- Dr. Paul Franzon
- Dr. Keith Townsend
- Dr. Ioannis Viniotis

Two new faculty joined the department in Academic Year 1993-94.

- Dr. Gary Rubloff was appointed as a Visiting Professor in ECE and as Associate Director of the Center for Advanced Electronic Materials Processing. Gary had a distinguished career at IBM in the areas of semiconductor processing and manufacturing systems before joining the ECE Department and we look forward to his contributions to the educational programs of the department.
- Dr. Franc Brglez also joined the ECE faculty as a Visiting Research Professor and Director of the CAD Benchmark Laboratory. Dr. Brglez was formerly with Bell Northern Research and later with MCNC and he specializes in Computer-Aided Design for VLSI circuits and systems.

Two ECE faculty were away from the department on special leave or assignment during AY 1993/94.

- Dr. John Grainger was on leave-of-absence without pay for AY 1993-94. He is working with a small company in California specializing in electric power system analysis and design.
- Dr. Michael Littlejohn was on an IPA with the Army Research Office in the Research Triangle Park during Fall 1993. During Spring 1994, Dr. Littlejohn divided his efforts between the IPA assignment at ARO and a special assignment with the NCSU Office of the Vice Chancellor for Research.

III. Students

A. Honors

The following students were specially recognized by the ECE department for their achievements in AY 1993/94.:

- Outstanding CPE Graduate, Fall 1993: Stephen C. Demarco
- Outstanding EE Graduate, Fall 1993: Stephen Edwards
- Outstanding CPE Graduate, Spring 1994: Vankhan Nguyen
- Outstanding EE Graduate, Spring 1994: Dewey Austin
- Outstanding IEEE Student, 1994: Kevin Gard

During Spring 1994, the following students received recognition by the College of Engineering:

- Engineering Senior Award for Scholarly Achievement: William Rhett Davis
- Engineering Senior Award for Citizenship and Service: Hao Nguyen Dinh
- Engineering Senior Award for Leadership: Jonathan Turner
- Katherine Stinson Scholarship for 93-94: Vankhan Nguyen

B. Student Activities

The 96th Anniversary ECE Department Banquet was held during Spring 1994 in the McKimmon Center on campus. Mr. Bill Nussey, class of 1987 and CEO of Da Vinci Systems, was the keynote speaker. The theme of Mr. Nussey's address was that the unparalleled advances in telecommunication technologies offers extraordinary opportunities for ECE students today. Recognition of the accomplishments of ECE students, the HKN induction ceremony, acknowledgment of the awards received by ECE faculty, and of faculty retirements were all included in the program

The department conducted two graduation ceremonies during AY 1993-94. The Fall ceremony was held in the Stewart Theater and was keynoted by Dr. Arnie Reisman. The Spring Ceremony was held at the Edenton Street Methodist Church which is believed to seat over 1300 people. Unfortunately, there was an overflow of about 200 people. This is a perennial problem for the ECE Spring graduation that we have been unable to resolve even though we have moved the ceremony to successively larger facilities. Christopher Hobbs, an ECE Graduate Student, and Howard Tant, the ECE Bookkeeper provided the musical program prior to the ceremony. Dr. John Sutton was the faculty keynote speaker.

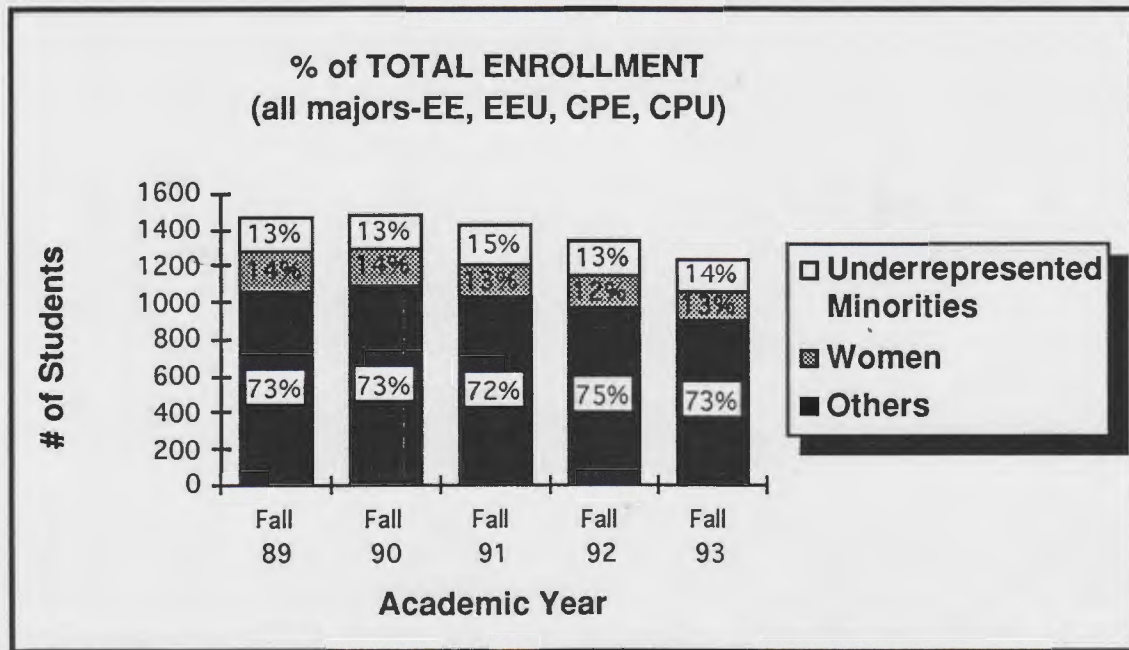
The IEEE Student Branch conducted a Student Professional Activities Conference (SPAC) during Spring 1994. The SPAC is used by ECE undergraduate students to obtain credit for the requirement that they attend a professional meeting. A number of IEEE students attended the IEEE SOUTHEASTCON meeting in Miami Florida during Spring 1994. This meeting was particularly significant because the NCSU IEEE Student Chapter will serve as host for the 1995 IEEE SOUTHEASTCON meeting in Raleigh, NC. IEEE students also led an effort to require that all engineering students attach a statement to their work to the effect: "I have neither given or received unauthorized help on this work." This proposal is under consideration by the College of

Engineering Executive Committee. The faculty adviser for the IEEE Student Branch during AY 1993-94 was Dr. Hatice Öztürk.

The department supported approximately 60 half-time teaching assistants during AY 1993-94. Approximately four of these students were supported by direct state funding; the remaining from faculty release time or from temporary salary allocations.

C. Minority Representations

Data on the distribution of minority, women and all other students enrolled in the undergraduate programs of the department are shown by the following chart:



(Underrepresented minority includes African-American, American Native, and Hispanic.)

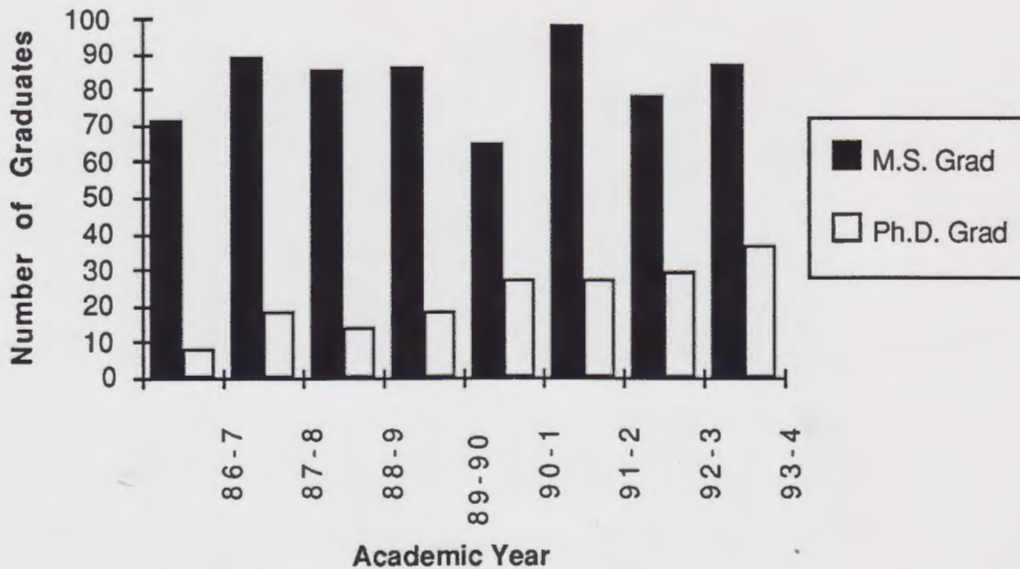
This chart indicates a gradual (and disturbing) decline in the total numbers (although not in percentages) of both women and minorities enrolled in ECE.

There are 11 African-American Ph.D. students and 11 African-American M.S. students enrolled in the ECE department for a total of 22. Several of these students hold fellowships, e.g., Mr. Vincent Wilburn and Mr. Daryl Simpson have Patricia Harris Fellowships awarded by the U.S. Department of Education; Ms. Sonetra Howard has a NASA Fellowship, and Ms. Mabel Watson has an ONR/HBCU Future Faculty Fellowship. Also, Mr. Wilford Hill and Ms. Latonia Barber have NSF GEE Fellowships through AEMP and Mr. Donovan Moxey has an AEMP full fellowship.

D. Program Statistics

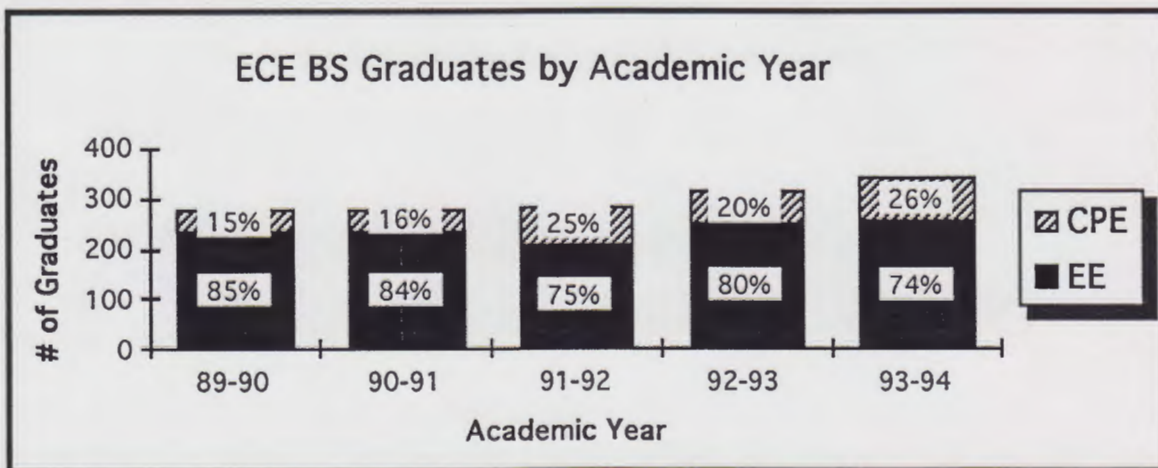
The doctoral programs of the department have shown a steady growth in degree productivity over the past few years and during AY 93-94, the department awarded a new record of 37 Ph.D. degrees. The chart below depicts the historical trends in the production of students obtaining graduate degrees in ECE. Production of M.S. degrees by the department has varied between 80 and 100 with a production of 87 M.S. degrees in AY 93-94.

ECE Graduate Production



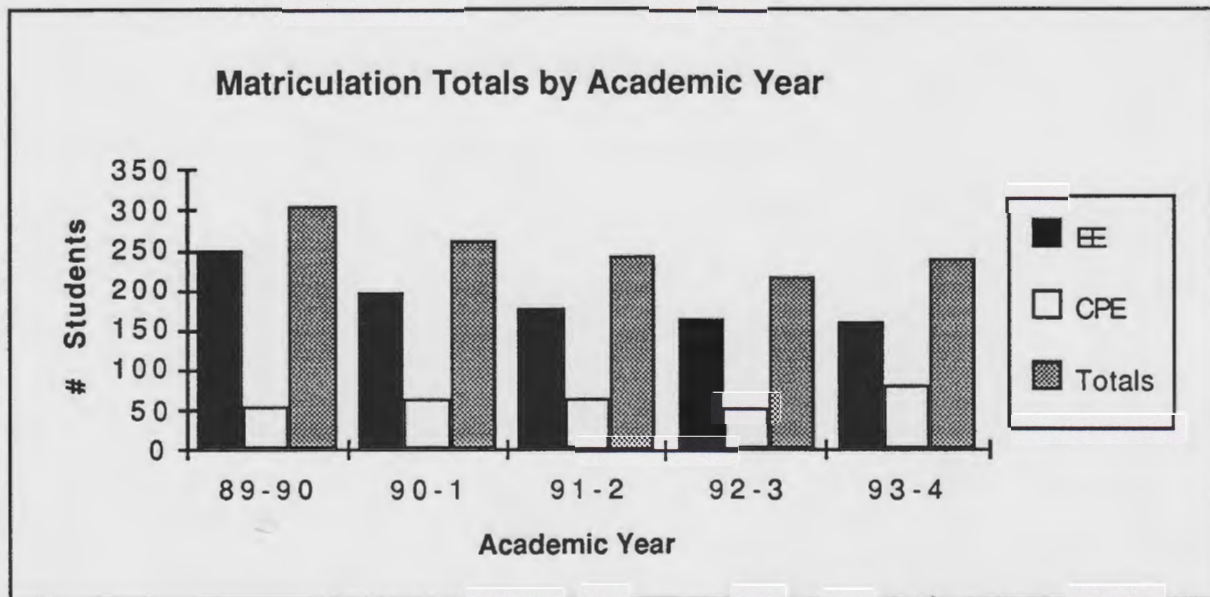
Each year, the department receives between 3,000 and 4,000 inquiries about its graduate programs. Between 300 and 500 applications for admission to the program result from these inquiries. In Fall 93, 198 students were admitted to the program from an applicant pool of 475. Ninety-two new graduate students subsequently enrolled in the program; 78 in EE and 14 in CPE. The total number of students enrolled during Fall 1993 was 365 of whom 191 obtained some form of financial support.

Bachelor of Science degree production is shown by the chart below:



From the above chart, it is apparent that B.S. degree productivity has been steadily increasing. We have not completed an analysis of this data, but it may indicate that the numbers of entering students who are successful in ECE has increased or it may indicate that a 'bulge' of students have completed their degree programs, aided perhaps by the reduction from 132 hours to 120 hours in the ECE curricula. Certainly high graduation rates have the effect of reducing the

number of students enrolled if not offset by an equal number of students matriculating into the department. However, there has been a gradual decline in the number of matriculants into the EE program as indicated by the following chart.



The numbers used in the preceding chart for Academic Year 93-94 are estimates since the matriculants for summer session of 1994 are unavailable to us at the present time. Of course, the total number of students entering the EE and CPE programs also depends on the number of internal and external transfer students. Typically, transfers are on the order of 25% of the matriculants; however, these data are not available at the time of this writing.

IV. Instructional Program

A. Curriculum Development

The department implemented a revised EE curriculum affecting freshmen entering the EE program in the fall of 1993. The new curriculum requires 125 credit hours, up five credit hours from 120 hours required of students in the previous curriculum. The change was in response to the institution of the General Education Requirement in Fall 1994 which placed the 120 hour curriculum very near minimum acceptable limits for accreditation. Highlights of the changes include addition of a course in probability and statistics, addition of two senior elective ECE courses, addition of a computer course in C++ language, addition of an elective course in humanities and social science, removal of a course in probability, removal of a Computer Science course in the Pascal Language, and removal of a required ECE junior course. The new curriculum is expected to better prepare EE students for employment in industry and government.

Also, in recognition of the changes in the NCSU General Education Requirement, the Computer Engineering curriculum was revised from 122 hours to 124 hours, effective Fall 1994. Significant changes include:

- Addition of three credits of humanities and social science elective,
- Replacement of MA 314 with a course in probability and statistics (ST 370),
- Replacement of the numerical methods elective with a one credit course in numerical applications to differential equations,
- Addition of six credits of senior elective,
- Removal of three credits of free elective.

Faculty from the ECE Department were active participants in the SUCCEED Program that is striving to radically alter the nature of undergraduate engineering education. (North Carolina State University is the lead institution for a coalition of southeastern universities implementing the SUCCEED program under the sponsorship of NSF.) Dr. Ben O'Neal served as the NCSU campus Program Coordinator for SUCCEED and for part of the year, Dr. John Sutton served as Director of the SUCCEED Center for Engineering Practice. Dr. John Hauser worked with faculty in Mathematics and Physics under the auspices of SUCCEED to conduct an experimental integrated course for freshmen entering the Electrical Engineering Department. The basic idea was to provide instruction on engineering, mathematics, and physics in a common setting that was equipped with modern computing and data collection equipment for class experiments. We are in the process of assessing the lessons learned from this experiment. Clearly many of the students established an identity with the department and achieved degrees of computer literacy that would have otherwise been difficult. However, this type of educational experience is quite expensive to provide and we are uncertain of its impact on student retention.

Dr. Ioannis Viniotis has developed a prototype learning tool for probability based on the EOS computing system. He has created a *push and pop* windows environment supported by the scientific software package MATLAB that is running in background, to encourage students to explore probability concepts and applications. Learning aids of this type may provide a clue to how distance learning environments can be constructed in the future.

Drs. Tom Miller and Arné Nilsson have worked on a desktop conferencing project under the auspices of SUCCEED. The idea is to allow workstation-to-workstation visual interaction over Internet or other networks.

The ECE Undergraduate Design Center (UDC) had another banner year in AY 1993-94. The following companies have remained active direct supporters of the UDC: IBM(RTP), IBM(Cary), AT&T, Square D, Duke Power, Martin Marietta, ABB, Alcatel, and BNR. Approximately 300 students were involved in over 130 UDC projects during AY 1993-94. Mr. Glen Williamson continued his service as a Design Specialist for the UDC and contributed in many ways to the overall quality of the results obtained by the student teams. We are sorely limited by the space available in DAN 408 to conduct the projects and this has resulted in limited student access to needed equipment. In addition, the heavy (sometimes 24 hour) use of DAN 408 has made it difficult to maintain adequate tracking of laboratory equipment since students sometimes move the equipment to other locations for use and neglect to return it.

The ECE Undergraduate Design Center conducted a wide range of projects and we cannot adequately describe them in this brief report. Some novel UDC activities include: IBM-Cary personnel taught a one-hour course in the SMALLTALK language during Fall 1993. Then in Spring 1994, several students who had taken this course conducted on-site projects at IBM-Cary projects that used their SMALLTALK skills. The ECE Entrepreneurs course featured participation by freshmen through senior students in projects that not only had a technical thrust but also a business/marketing emphasis. For example, the group led by Dr. Tom Miller undertook to develop a system to support multiple video distribution on an IBM Local Area Network. The presentation and system demonstration to the IBM technical staff at the end of the Spring semester was impressive and extremely well received. Yet another initiative derived from the successful projects of the ECE UDC is being launched during Summer 1994. Three ECE students working with ECE faculty and with IES personnel are undertaking to provide an improved user environment for control of a production facility at Westinghouse in Winston-Salem. They are rewriting a commercial real-time control software package to provide an easy-to-use windows environment for Westinghouse operators. To our knowledge, this is the first on-campus summer intern program that has been conducted by the department. The students are utilizing the UDC facilities for their work and plan to deliver a working system to their customer by the end of Summer 1994.

B. Program Reviews

The department conducted a five-year evaluation of its leadership and programs. A comprehensive survey of faculty indicated that faculty believed that the performance of the department head was excellent, the performance of other department administrators was very good, the performance of the faculty was very good, the graduate and undergraduate programs were very good, the dean's moral and financial support was evaluated as good, and the provost's moral and financial support of the department was fair.

V. Research

A. Volume of Activity

The data on ECE research expenditures for AY 1993-94 is unavailable at this time.

B. Specific Achievements of Significance

On June 1-3, 1994, the NSF Engineering Research Center for Advanced Electronic Materials Processing conducted a program review after six years of operation. We believe that the accomplishments of this outstanding interdisciplinary center are exemplary. For example, 54 M.S. degrees and 49 Ph.D. degrees have been awarded during the six years of operation of the center. Approximately 415 journal papers, 341 technical conference papers and 19 contributions to books have been made by center researchers. Many basic contributions have been made in the areas of i) Dielectrics and Polysilicon, ii) Selective Deposition, iii) Materials Analysis and Characterization, iv) Advanced Devices and Test Structures, and v) Equipment and Process Integration. The first cluster of tools is now functional, device fabrication and characterization is underway, and split lots of wafers are being run in cooperation with industry. Construction of the second more complex cluster tool is well underway. The department acknowledges the leadership of Dr. Nino Masnari, the AEMP Director, and the accomplishments of the many contributors to the AEMP research program who have created an important national resource. The reception by industry of our graduates is especially gratifying.

The Power Semiconductor Research Center (PSRC) under the leadership of Dr. B. Jayant Baliga has had another outstanding year. In the period July 1, 1993 to June 30, 1994, 27 PSRC technical reports were sent to sponsors, six papers were published in international journals and 13 papers were presented at international conferences. Dr. Baliga has completed a new 600 page textbook entitled *The Physics of Semiconductor Devices* that will be published during Fall 1994. Twelve patent disclosures were generated resulting in six patent applications. PSRC has now been issued twelve patents based on its research and several more patent awards are anticipated in the near future. We believe that the PSRC has become a leading international center for power semiconductor research.

Dr. Sarah Rajala assumed the position of Director of the Center for Communications and Signal Processing (CCSP) in Fall 1993. CCSP continued its tradition of excellent research with foci being i) Digital Communication and Optimization, ii) Networking and ISDN, and iii) Color Image Processing. There is considerable industrial emphasis on communication technologies at the present time, especially on wireless communications and on high speed networks. A concept paper entitled *The North Carolina Initiative in Telecommunication Technologies* was stimulated by the strong industrial demand for technical infrastructure and by the planned North Carolina Information Highway. Many authors at MCNC and NCSU contributed to this draft that is now being used as a starting point for a technology planning initiative by the North Carolina Alliance for Competitive Technologies, (NC ACTs). CCSP is in the process of metamorphosis into a regional research center. It appears that in the future, CCSP will include research projects at Duke University, principally in the area of reliable distributed computing.

The Electric Power Research Center (EPRC) continued its research program in three areas: i) Distribution Automation, ii) Power Quality, and iii) Motor Drives. Dr. Mesut Baran's work on protection requirements for customer-owned generation against system islanding received praise from member electric utilities as being far ahead of related work. Dr. Mo-Yuen Chow's research on the application of neural networks produced software that is now being used by Duke Power to identify the causes of power outages. Dr. Arthur Kelley's research on the measurement of line impedance and the design of adjustable speed drives for residential applications attracted two equipment manufacturers to join the EPRC. His ASD invention resulted in a patent application that has great potential for increasing the efficiency of heat pumps and reducing their manufacturing costs. For the first time, half of EPRC's members are equipment manufacturers and we are optimistic that other manufacturers will join the EPRC next year.

The Center for Robotics and Intelligent Machines (CRIM) at North Carolina State University is presently conducting research in multi-sensor based reactive robotics. MARGE (Mobile Autonomous Robot for Guidance Experiments) serves as a testbed for sensor fusion, motion planning, landmark recognition, and fuzzy behavior research. MARGE uses a colony of inter-connected fuzzy controllers for robust sensor-based reactive navigation. MARGE won first place in an event called *Robot, Rearrange the Office*, at the 1993 AAAI Mobile Robot Competition in Washington DC. Contenders in this competition included top-ranked research universities and laboratories including MIT, Stanford, CMU, Michigan, and Hughes. CRIM is recognized for its research in multi-sensor fusion and integration. Two patent disclosures were filed in 1993 for a solid-state proximity sensor and a skin-like tactile array sensor.

A wide array of other faculty research projects were underway in AY 1993-94. Examples include research in distributed computing, projects in the design of very high speed digital circuits based on delay management in clock and data paths, studies on design for interconnect integrity, design and fabrication of microsensors for cardiovascular studies with the Duke Engineering Research Center, research to improve cochlea implant technology, modeling and characterization of microwave devices, application of MEMs (Microelectromechanical) technologies, test methodologies for VLSI circuits, advanced modeling and simulation studies for far-submicron devices, and many other activities.

Under the sponsorship of the Semiconductor Research Corporation, SEMATECH and ARPA, Dr. Franc Brglez has created the CAD Benchmark Laboratory (CBL). The mission of CBL is to develop and implement mechanisms to postulate, instantiate, evaluate, and deliver integrated circuit benchmarks at various levels of abstract representation, e.g., behavioral, logic, circuit, etc. The CBL benchmarks will be used to evaluate the performance of new CAD tools developed by university and other research laboratories. During Spring 1994, CBL began to become operational and is subleasing space from MCNC in the Research Triangle Park. Computer and communication facilities are being designed and equipment is being purchased. In the steady-state, CBL will probably provide funding for about six Research Assistants and for a limited number of staff personnel.

VI. Extension and Public Service

A. Volume of Activity

Our most significant extension activity is derived from the ECE Undergraduate Design Center led by Dr. John Sutton. This program involves many area companies and results in visits to the companies by ECE faculty and students. Indeed, many of our students conduct their projects on the company premises. On the order of 70 to 80 industrial projects were undertaken, probably involving about 150 students. Over 20 companies sent representatives to review the student poster displayed by ECE and other departments during Engineering Design Day.

ECE research programs provide another effective mechanism for interaction with industry. Since many of these programs are sponsored by industry, involvement of industry personnel is fairly common. For example, the Center for Advanced Electronic Materials Processing runs industry wafers through a number of processes on the single wafer processing system constructed by researchers in the AEMP central laboratory.

B. Specific Achievements of Significance

During the summer of 1993, several faculty from NCSU participated with Mr. Rick Carlisle, Senior Economic Adviser to Governor Hunt to develop a concept to promote the competitiveness of key industry sectors in North Carolina. Individuals at NCSU who were involved in the project include Dr. Harold Hopfenberg, Dr. Frank Hart, Dr. Jimmie Suttle, Dr. Michael Littlejohn, and Dr. Ralph Cavin, III. The concept for the North Carolina Alliance for Competitive Technologies (NC ACTs) resulted and a proposal was submitted to NIST for funding under the auspices of the Technology Reinvestment Program. NC ACTs' mission is to develop technology roadmaps needed for world-class industries in key industrial segments. The roadmaps are to be used to guide the strategic investment by North Carolina in the development and deployment of technology capabilities within North Carolina. The proposal was funded.

VII. Administration and Staff

A. Personnel: New Appointments, Professional Activities, Kudos

Mrs. Sharda Sawhney has been assigned to ECE to perform the pre-audit function for ECE grants and contracts. She was formerly assigned to the Office of Administrative Services in Page Hall and has recently been relocated to Daniels Hall.

Mrs. Connie Reno, the ECE Administrative Assistant, has served on several administrative committees in the College of Engineering including one committee that is attempting to develop a computerized system to automate the generation of budgets and forms during the proposal process.

The copy/mail clerk position has been reduced to a one-half time position in view of budget reductions. Ms. Lynnette Barber currently holds this position. The department is no longer providing centralized copying services for faculty, staff and students. ECE staff and faculty now copy materials on their own.

Ms. Margaret Hudacko is assuming increased responsibility for the PC computing environment in the ECE Department. This new and additional assignment was necessitated by the transfer of Mr. Andy Burnette to Engineering Computer Operations to support faculty EOS research computing in Daniels Hall.

B. Private Fund-Raising Efforts

Corporate and private giving to the department has been relatively modest during AY 1993-94. This is probably somewhat a reflection of the state of the economy and is an area that warrants special attention during AY 1994-95.

C. Facilities and Equipment

Under the auspices of SUCCEED, DAN 219 was converted from a power laboratory into a classroom designed to support interactive computing and data collection in support of the integrated freshmen course led by Dr. John Hauser. A network of twenty 486-class machines was installed to be used in data collection from in-class experiments conducted by the students.

A projection system was purchased for use in displaying computer screen data for viewing by the class as well as transparencies and other forms of visual information.

Construction on DAN 308 has continued with a goal of converting this room to a modern space to house fourteen graduate students. This project is scheduled for completion in July 1994.

DAN 109A, which was formerly part of the ECE Mechanical Shop, has been converted into about 500 ft² of office space for use by the technical support staff who work in the DAN 115 Microelectronics Laboratories. This project should be complete by July 1994. In addition, equipment and personnel have been relocated from the DAN 112 space in preparation for the relocation of Dr. McLarty's laboratories that are now housed in Research II on the Centennial Campus.

The clean-up of the DAN 444/445 laboratories and the ancillary space that was damaged by the May 1993 fire has continued throughout AY 1993-94. In May 1994, the space was declared to be in a state where restoration of facilities could begin. The ECE Department has been working with the College of Engineering to plan future use of this space. Drs. Bedair and Kolbas have been asked to define chemicals that would be used in the laboratories in the future and these lists have resulted in a continuing round of negotiations with the NC Department of Insurance. We have been working to develop a plan that would enable Dr. Bedair to relocate his laboratories to the Research II Building on Centennial Campus and thus reduce the need to handle hazardous materials on the fourth floor of Daniels Hall. At this writing, we are hopeful that arrangements can be worked out to accommodate Dr. Bedair's laboratories on the Centennial Campus. These negotiations have been quite lengthy and have required concessions and trade-offs by many individuals, departments, and colleges. If suitable arrangements are made for Dr. Bedair's laboratories, the space vacated in Daniels 444/445 will be reassigned to use by the ECE Solid-State Electronics Program with the stipulation that all new applications must not require the use of hazardous materials.

Renovation of Daniels 410/412/414 is underway. Work includes the provision of central air conditioning AC, repainting, refinishing the floors and removal of power panel that is no longer in use. We hope to complete this project during Summer 1994 to prevent recurring damage to computers and equipment due to excessive heat.

The department has purchased a SUN 20 workstation that is to be connected to the EOS framework and that is to be used as resource for research computing by the ECE faculty and students. Many of the problems that we are addressing are computationally intensive and we are hopeful that this new computer will provide some relief.

VIII. Recommendations and Concerns for the Future

The department offers many excellent educational opportunities and is staffed by an outstanding faculty that is dedicated to ECE students. In the complex external environment faced by all educational institutions, there is but one viable course for us, we must continue to focus on quality and excellence in all of our endeavors. We are confident that electrical and computer engineers must play a key role in enhancing economic development and in providing solutions to many of the societal problems that we face, e.g., environment, health care, infrastructure, etc. We also believe that the ECE Department can and will provide well-educated graduates who can contribute to the solution of many of the problems facing mankind. Our optimism about the future of the profession and the important role of the department is tempered by several challenges that face us in the near-term. Some of these challenges are:

- ECE must be permitted to aggressively recruit outstanding faculty to replace those that we have lost due to retirement or for other reasons. The department must position itself by recruiting carefully to address new challenges in the electrotechnologies and to also strengthen traditional

areas of emphasis. The degree of productivity of the department is extraordinarily high relative to peer institutions, and thus the addition of new faculty is critical.

- Forthcoming changes in federal laws on the conduct of federal research will almost certainly force the department to pay several soft-dollar staff from indirect cost returns and to assume more of the responsibility for material supplies needed in the conduct of the research. If additional indirect cost returns are not forthcoming to the department, then ECE will be much less able to provide funds for program development or to enhance the research environment and capabilities of the department.
- The department continues to suffer from very limited space in that new teaching laboratories cannot be created. For example, we need to significantly expand the space for the Undergraduate Design Center, we need to create a laboratory for optical communication studies, we need a laboratory for real-time control studies, we need to replace the microwave teaching laboratory that was lost due to other pressures, we need to expand the microsensors/metrology laboratory, we need to create a system-building laboratory for Computer Engineering Students, and many others. It is critical that as plans are made to relocate some of the Daniels laboratories and personnel to the Engineering Graduate Research Center, a backfill and renovation plan be developed to address these needs.
- We are concerned about the long-term effects of declining numbers of undergraduate students enrolled in ECE. If the net result is that the enrollment begins to level-off, the effect may be to bring teaching loads to a more manageable level for the department. In any case, the ECE needs to develop the resources and a program to recruit more of the top high school graduates into the department.
- The decline in the numbers of women and minorities in ECE is discouraging. New ideas are needed to address this continuing problem. We believe that a partial answer to retention lies in recruiting more African-American and women faculty members. The department's plans to devote one or two of its existing open positions to the recruitment of under-represented individuals is an important first step.