

# About the Illinois ECE Series

The Illinois ECE Series continues a tradition in undergraduate education that has been practiced for more than a century by faculty in the Department of Electrical and Computer Engineering at the University of Illinois. That tradition, which has come to be called “the Illinois Way,” balances adherence to the tried-and-true with readiness to change decisively in order to shape a better future.

The Illinois Way encompasses more than textbooks. Early curricula in the department (then called Electrical Engineering) included courses in military drills, drafting, and surveying. Later, Illinois would be the first program in the nation offering a freshman introduction to concepts in circuits, electromagnetics, electronics, control, and digital systems. Computer-based education in the department dates back to 1960 with PLATO (Programmed Logic for Automated Teaching Operations), a time-shared network that gave rise to one of the world’s first online communities. Now, students all over the world take ECE courses using Web-based learning environments developed and used by our faculty. The department’s greatest pride is its world-class undergraduate instructional laboratories. A century ago, facilities consisted of batteries, electrical machinery, and illumination equipment. Now, the department houses unsurpassed educational laboratories for integrated circuit fabrication, digital signal processing, control systems, computer architecture, and more.

Of course, popular and innovative textbooks have long been a part of the Illinois Way. Former department head and longtime engineering dean at Illinois, William L. Everitt, edited over 100 titles for a series of engineering textbooks published by Prentice Hall in the middle of the last century. Everitt also wrote textbooks. His *Communication Engineering*, first published in 1932 and revised into the 1950s with Illinois colleague G. E. Anner, deserves credit for helping push the electrical engineering profession from its pre-World War II emphasis on power systems to its postwar emphasis on information technology and electronics. Edward C. Jordan, head of the department from 1954 to 1979, wrote *Electromagnetic Waves and Radiating Systems*, long a standard textbook in the field, first published by Prentice Hall in 1950 and revised in 1968. Additionally, M. E. Van

Valkenburg, another long-standing faculty member who also served as head and dean, wrote several influential textbooks, including *Network Analysis*, one of the most internationally popular engineering texts of all time, first published by Prentice Hall in 1955 and revised in 1964 and 1974.

It is fitting, then, that the Illinois ECE Series began in 2004 with the sixth edition of N. N. Rao's *Elements of Engineering Electromagnetics*, the special India Edition of which you now hold in your hands. Professor Rao was hired to join the Illinois faculty in 1965 by Jordan. Prentice Hall published the first edition of *Elements* in 1977; by the time of its fifth edition, dedicated in 2000 to none other than Ed Jordan, the text had established an international reputation for its grounding in time-honored practices even as it evolved progressively from one edition to the next. That is the essence of the Illinois Way.

The Department of Electrical Engineering was established in 1891 when the University of Illinois, one of the first public land-grant institutions chartered after President Abraham Lincoln's signing of the Morrill Land Grant Act, was just 24 years old. Enrollments increased, but steadily, until World War II when the U.S. armed services contracted with the university to train recruits, prompting a boom in the student body. The war also boosted the volume of research contracts handed out by the government, and when Everitt became head in 1944 he took advantage of the new circumstances and led the department to embrace research and teaching in a wide array of electrical engineering-related fields. A computer engineering curriculum was established in the department in 1972, reflecting the department's close involvement with computer work on campus dating back to 1952 with ILLIAC I, one of the first computers built and owned by an educational institution (and which later served as the mainframe for PLATO). In 1984 the department was renamed the Department of Electrical and Computer Engineering.

Today the department enjoys a longstanding, international reputation as one of the premier places in the world for the study of electrical and computer engineering. As of 2006, ECE faculty members advise and instruct more than 1400 undergraduate and over 550 graduate students, while carrying out research funded at a level of \$35 million per year. The department is headquartered in the venerable Everitt Laboratory and enjoys world-class, interdisciplinary, Urbana-Champaign campus facilities such as the Beckman Institute for Advanced Science and Technology, the Coordinated Science Laboratory, the Grainger Engineering Library, the Micro and Nanotechnology Laboratory, the National Center for Supercomputing Applications, and the University of Illinois Research Park. Faculty, students, and alumni of the department have established state of the art in fields ranging from microelectronics and nanotechnology to telecommunications, photonics, signal processing, imaging, electromagnetics, bioengineering, circuits, computer engineering, control systems, and more. A sampling of their achievements follows.

- Professor Josef Tykociner invented a process for making moving pictures with sound. In 1922, he was the first person in the world to demonstrate sound-on-film technology.

- Professor John Bardeen joined the faculty in 1951 after co-inventing the transistor at Bell Labs in 1947. Bardeen would go on to develop the theory of superconductivity at Illinois in 1957. He shared the 1956 Nobel Prize in physics for the invention of the transistor, and the same prize again in 1972 for the theory of superconductivity. He remained on the ECE staff until his death in 1991.
- Professors Floyd Dunn and William Fry conducted pioneering research in the use of ultrasound as a noninvasive diagnostic and surgical tool as early as the 1950s.
- Professor Heinz von Foerster's Biological Computer Lab, now legendary worldwide, was the nerve center of U.S. cybernetics research from 1958–1975, developing some of the world's first parallel computers and prefiguring present-day campus interdisciplinary efforts in bioengineering, cognitive science, art and technology, and human–computer intelligent interaction.
- Alumnus Jack Kilby invented the integrated circuit in 1958 while working for Texas Instruments. Kilby won the 2001 Nobel Prize in physics for his invention.
- Student Dwight Isbell invented the frequency-independent log-periodic antenna in 1959, laying the groundwork for Professor Paul Mayes and graduate student Robert Carrel, who the following year developed the log-periodic resonant-V antenna, which would become the most popular antenna for television reception.
- Professor George W. Swenson established radio astronomy at the University of Illinois in 1959 with construction of the Vermilion River Observatory. Swenson would go on to serve as head of both the EE and Astronomy departments, chair the design group for the Very Large Array, and pioneer techniques and instrumentation in the field of animal telemetry.
- Professor Y. T. Lo created antenna designs that improved the efficiency of giant radio telescopes, military and civilian radar, airborne and space vehicles, and ground-based communication systems during the Cold War.
- Professor C. T. Sah, who was attracted to Illinois in 1962 by Bardeen, pioneered the development of complementary metal oxide semiconductor (CMOS) technology and the theory of MOS transistors, which became the workhorses for chips used in computers as transistors evolved from junction-type integrated circuits to field-effect devices.
- Professors and alumni Donald Bitzer and H. Gene Slottow, along with graduate student Robert Willson, invented the plasma display panel in 1964 as an interface with PLATO workstations. In 2002 they received

an Emmy recognizing the importance of their work to the television industry.

- Alumnus Alfred Cho developed molecular beam epitaxy during the 1970s while working at Bell Labs.
- Professor and alumnus Nick Holonyak Jr., who had been Bardeen's first graduate student at Illinois, joined the ECE faculty in 1964 after inventing the first practical light-emitting diode at General Electric. Holonyak and graduate student Ed Rezek demonstrated the first quantum-well laser in 1977. Holonyak, still an active member of the ECE faculty, won the 2002 National Medal of Technology, the 2003 IEEE Medal of Honor, and the 2004 Lemelson-MIT Prize, among many other honors and awards.

The Illinois ECE Series has been conceived with the aim of reintroducing electrical and computer engineering students worldwide to the Illinois Way. Students who appreciate these books are encouraged to visit ECE-Illinois on the web at [www.ece.uiuc.edu](http://www.ece.uiuc.edu), or in person at the Everitt Laboratory on the Urbana-Champaign campus.