“We aim to endow our students with a deep technical foundation that allows them to succeed years after they graduate, provide them with the exposure to liberal arts that they will need to develop empathy and recognize opportunities ahead of the competition, hone their communications, presentations and interpersonal skills and develop their ability to take calculated risks.”

We celebrated our first anniversary in the new Engineering Education and Research Center (EERC) at the beginning of this fall semester. One of my colleagues best captured the transformative effect of the building on all of us when he said, “the building has worked its magic on our students, staff and faculty.” Indeed, our new facilities and our phenomenal human capital, students, staff, faculty, alumni and friends, are accelerating the execution of our vision to become a teaching, research and disruptive innovation department.

We aim to endow our students with a deep technical foundation that allows them to succeed years after they graduate, provide them with the exposure to liberal arts that they will need to develop empathy and recognize opportunities ahead of the competition, hone their communications, presentations and interpersonal skills and develop their ability to take calculated risks. Our new teleconferencing capabilities embedded in our classrooms have enabled us to expose our students to the very high visibility in professional venues and the national and international media. The quality of our facilities and our current faculty, the close collaborations we maintain with several other departments on campus, including computer science, mathematics, physics, neuroscience, and the medical school, allowed us to recruit two highly accomplished professors in the other course. Next year, we will begin to roll out a sequence of introductory courses that integrate circuits, software engineering, signals and systems, communications, physics, devices, electromagnetics, data sciences, and technical communications. These changes are a direct response to the rapid evolution of our disciplines and what we are hearing directly from the most innovative companies, venture capitalists, and entrepreneurs.

I am also happy to report again that our faculty continues to win prestigious awards and recognitions, and maintain a very high visibility in professional venues and the national and international media. The quality of our facilities and our current faculty, the close collaborations we maintain with several other departments on campus, including computer science, mathematics, physics, neuroscience, and the medical school, allowed us to recruit two highly accomplished professors in quantum computing and brain machine interfaces from Yale and the École Polytechnique Fédérale de Lausanne (EPFL), Switzerland.

This is my last message to you as chairman of this great department. I would like to thank all of you—our students, staff, faculty, friends, partners, and alumni—for your dedication, generous time and financial support. Our accomplishments are truly the story of your commitment and success.
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Virtually Extending the Classroom

Texas ECE is using synchronized classrooms to advance education options for students through remote learning. The department offers a MS degree through a synchronized classroom that is simultaneously taught to a live class, as well as streamed as a virtual classroom. The core coursework is flexible to meet the specific needs of each student, and the virtual classroom offers professionals who may not have the ability to attend live courses to advance their education and skills without sacrificing their professional opportunities.

Internet of Things Lab

Texas ECE is developing a state-of-the-art Internet of Things (IoT) Lab within the National Instruments Student Project Center which will focus on hands-on education in the latest technology in interrelated computing devices and digital machines. First-Year Design Experience courses will be taught in labs and paired with lectures to teach ideation, planning, and product development.

Integrated Learning

Profs. Milos Gligoric and Jonathan Valvano will teach special integrated sections of courses in Software Design and Implementation and Embedded Systems. Because topics of classes overlap, pairing courses and teaching them concurrently benefits and accelerates the students’ knowledge of the material. Topics introduced in one class can be reinforced in the other. Taking certain courses early in an academic career also improves chances for the students to obtain competitive internships.

Teaching in Bytes

Bytes Courses are envisioned as small courses focusing on specific skill sets that our students need to be successful in internships and careers that are not part of the core coursework. Topics have included Blockchain technology and cryptocurrency, mixed signals and design with fabrication, printed circuit board design, and a course on developing professional skills.

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First-Year Design Experience

First-Year Design Experience (FDE) is a two semester “bite-sized” course where students form groups of five and use the conceptual topics they are being taught to design components, bigger components, and, finally, systems. It is a combination of a top-down and bottom-up learning approach that introduces them to a hands-on design experience they will use throughout their academic careers. For example, this year’s first-year students will be creating an Arduino based sensor/actuator system using the Blynk IOT Application. The FDE takes advantage of the two-story, 23,000 sq. ft. National Instruments Student Project Center for weekly lab work paired with a weekly lecture on topics relevant to the associated lab assignments.

Applied Cybersecurity Education

Texas ECE has partnered with The University of Texas Information Security Office for courses on Network Security and Privacy and Creative Security Operations using live data as the first in a series to teach students the latest technologies in cybersecurity. There is a massive shortage of cybersecurity talent across the planet, and that gap is forecasted to persist for the next several years. These courses will provide students with applied cybersecurity skills that are highly marketable to many industries.

Transforming the Classroom

Honors Degree Program

Texas ECE is launching an Honors Degree Program to provide a challenging, rigorous, and nurturing environment for our most ambitious and capable students. The program will admit approximately 40 students per year - which will ultimately comprise about 10% of the student population. Honors courses will provide greater depth and sophistication as compared to the standard coursework, and students will come away with an advanced understanding of the curriculum.
### Research Experiences for Teachers

RET is an intensive summer research and professional development opportunity where a K-12 teacher is paired with a UT faculty member and graduate student to work on a research project. The program’s goal is to have teachers leave as confident STEM educators to inspire the next generation. Design lessons and pieces of curriculum are prepared so that teachers can learn to bring engineering into math classrooms. Subjects this year included solar cells, flexible electronics, device physics, carbon nanotubes, and graphene.

### Solar Energy Storage Problem May be Solved in New Single-System Technology

Prof. Alex Huang and his research team have developed a way to integrate solar power generation and storage into one single system, effectively reducing the cost by 50 percent.

Generating power from the sun isn’t the problem. The technology has been there for decades. However, storing that power efficiently has been a challenge. That’s why the Department of Energy has awarded $3 million to engineering researchers at The University of Texas at Austin to overcome the Achilles’ heel of the solar power story since day one: how to store its energy.

“The project will develop the next generation of utility-scale photovoltaic inverters, also referred to as modular, multifunction, multi-port and medium-voltage utility-scale silicon carbide solar inverters.”

Prof. Alex Huang

### First-of-its-Kind Chemical Oscillator Offers New Level of Molecular Control

Prof. David Soloveichik and his research team show how to program synthetic oscillators and other systems by building DNA molecules that follow specific instructions.

“DNA can be used in a much more active manner,” Soloveichik said. “We can actually make it dance — with a rhythm, if you will.”

DNA molecules that follow specific instructions could offer more precise molecular control of synthetic chemical systems, a discovery that opens the door for engineers to create molecular machines with new and complex behaviors. Researchers have created chemical amplifiers and a chemical oscillator using a systematic method that has the potential to embed sophisticated circuit computation within molecular systems designed for applications in health care, advanced materials, and nanotechnology.

Soloveichik, along with Niranjan Srinivas, a graduate student at the California Institute of Technology, and the study’s co-authors, have successfully constructed a first-of-its-kind chemical oscillator that uses DNA components — and no proteins, enzymes or other cellular components — demonstrating that DNA alone is capable of complex behavior.

### SAVES: Situation-Aware Vehicular Engineering Systems

SAVES is a research center that addresses the challenges of wireless, networking, and sensing in vehicular systems. The center provides a common framework for the development of advanced vehicle connectivity, infrastructure to support connectivity, technologies for sensing, including imaging, radar and location, and applications of connectivity.

#### Cooperative Mapping for Automated Vehicles

Localization is essential for automated vehicles, even for simple tasks such as lane-keeping. A key enabler for large-scale up-to-date maps will be enlisting the help of the very vehicles who need the map—consumer vehicles—to build and update the map. This project explores the possibility of using multiple vehicles equipped with the kinds of sensors that are (or will be) common on cars (optical cameras, radar, IMU, and GNSS) to perform cooperative SLAM for improving and updating a point-feature map 3D map of the environment.

#### Automotive Radar Using WiFi and DSRC Signals

Recent mandates for automation in vehicular transportation safety have increased demand for radar applications such as forward collision detection and avoidance. The majority of current implementations of vehicular radar are mmWave radars, which are expensive and exhibit multiple security vulnerabilities. We have demonstrated the feasibility of a secure and cost-efficient IEEE 802.11-based system with radar capabilities via implementation and testing. Measurements demonstrate that our solution delivers meter level accuracy for single-target detection with significant potential cost reduction of future releases of vehicular radar.

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