

Twenty Years and Beyond of Engineering at West Texas A&M University

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Twenty Years of Engineering at WTAMU

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Abstract

Engineering programs began at West Texas A&M University in 2003. Engineering firms and government agencies identified a need to train and keep engineers in the greater Panhandle Region of the state of Texas. An existing engineering technology program was joined with programs in computer science and later mathematics along with new engineering programs in mechanical (2003), civil (2010), environmental (2012), electrical (2016), and master's level (2017). All of these programs are now consolidated in a College of Engineering (2020). The programs are tailored for 21st century needs with all four engineering programs gaining successful ABET accreditation as the first graduates were produced. This paper will discuss the process to build ABET accredited engineering programs as well as current and future plans for these growing and vital programs.

Introduction

West Texas A&M University (WTAMU) is a regional Master's level university in the Texas A&M University (TAMU) System located in Canyon, TX (Amarillo, TX metropolitan area). The university was founded in 1910 as a normal (teaching) university and joined the TAMU System in 1990. Current enrollment at WTAMU in Fall 2023 was 9061 students, of which 796 were undergraduate and master's level students in the College of Engineering¹. WTAMU has been a Hispanic Serving institution since 2015 and 32.9% Hispanic as of the 2021-2022 Academic Year².

As of January 2024, the ABET EAC database lists 39 public and private universities in Texas that have accredited engineering programs. Of these, nine universities are part of the TAMU system including WTAMU. Geographically, WTAMU is the only university in the Texas Panhandle region and one of just five universities (WTAMU, UTEP, UTPB, Angelo State, TTU) located in the western half of the state³.

Industry realized in the early 2000s that to attract and keep engineers in the Texas Panhandle region, it would be necessary to establish engineering programs at WTAMU. Existing engineering technology and computer science programs were moved to a new Department of Engineering and Computer Science in 2003. This department was placed in a renamed College of Agriculture, Science, and Engineering. In 2015, Engineering and Computer Science were elevated to a School. In January 2020, Mathematics was moved into a new standalone College of Engineering (CoE) which also kept the Computer Science program.

In the following part of this paper, a description of each engineering program and its growth are described. For programs striving to add their own engineering programs will benefit from the first-hand experience at WTAMU as four ABET accredited programs were developed.

Mechanical Engineering

The mechanical engineering program at West Texas A&M University received approval from the Texas A&M University System and the Texas Higher Education Coordinating Board to commence in the fall term of 2003. It primarily recruited from existing pre-engineering, community college graduates with an associate's degree in engineering (especially from Amarillo College), and from converts from the engineering technology program. Dr. Emily Hunt (College of Engineering Dean) and Dr. Roy Issa were two of the original inaugural faculty members and are still a vital part of this growing program.

ABET accreditation was granted after the first general review in 2005-2006, with the program officially accredited in 2006. Subsequent reviews occurred in 2011-2012 and 2017-2018, resulting in accreditations granted in 2012 and 2018, respectively. Over the years, the program has experienced steady growth, expanding from 5 students in 2005 to approximately 250 students in 2023. Despite the addition of students, faculty, and class offerings since the last general review, the program has not undergone any major changes. The program comprises six full-time faculty members in mechanical engineering, with three holding tenured positions and two occupying full professorships.

The program is predominantly conducted on campus, utilizing traditional classrooms and laboratories. Certain courses within the core and engineering curricula can be accessed online, giving students the choice to participate in either a web-based or traditional classroom setting. Within the mechanical engineering program, students can choose a specialization in Fire Protection Engineering. This particular track mandates completion of 9 hours of coursework in fire protection engineering, along with a senior design project focused on a fire protection engineering initiative. The conclusion of this track results in the attainment of a certificate in fire protection engineering, which is reflected on the transcript. This specialization is established through a collaboration with Pantex and the Department of Energy, driven by the identified demand for fire protection engineers within the National Nuclear Security Agency. The mechanical engineering program also provides a range of elective courses, such as sustainability, robotics, power plants, combustion theory, along with several approved 3000 level courses from civil, environmental, and electrical engineering programs.

Civil Engineering

The civil engineering program was approved by the TAMU system and Texas Higher Education Coordinating Board to begin in Fall 2010. There were existing pre-engineering students who intended to be in the program upon its start and synergies with mechanical engineering allowed the program to start right away.

Initial ABET accreditation commenced in the 2013-2014 cycle and became official in Fall 2015. The program went through accreditation cycles in 2017-2018 and 2023-2024. Civil and mechanical engineering shared many common resources, especially for labs, at the start. Author Dr. Kenneth

Leitch was one of two inaugural faculty members in civil engineering and covered these courses along with engineering technology and general engineering courses.

The civil engineering program is general in nature with the largest number of graduates going into structural, transportation, and geotechnical specialties within the discipline. The two civil engineering and two environmental engineering faculty ensure that all required civil engineering courses are taught as either lecture or lecture and laboratory in a face-to-face format. TXDOT, Pantex, and local consulting and land development firms are the largest employers for graduates of the civil engineering program.

A new initiative to promote civil engineering minors for other engineering majors will be launched for Fall 2024. This will allow for students in other engineering majors to expand their skillsets and marketability in the Texas Panhandle region and beyond.

Environmental Engineering

The environmental engineering program began in Fall 2012 (first faculty hired in Fall 2013) and was initially accredited in 2019, after the first graduates completed the program in 2018. Drs. Nathan Howell and Erick Butler are the inaugural faculty members in environmental engineering and are valued members of the CoE at the present time.

The environmental engineering program has undergone numerous changes over the years. These changes include switching thermodynamics and civil construction materials from being electives to required courses in the curriculum, combining air pollution and solid and hazardous waste design into one course, and shortening the requirements for completing senior design from two semesters to one. These changes have ensured that students enrolled in the program take a similar number of total credit hours as their peers in other engineering programs, provide consistent and attractive electives for students outside of environmental engineering to take, and increase competency in FE and PE environmental engineering exam topics.

Recently, the faculty in environmental engineering has begun contacting local employers (Phillips 66 and Xcel Energy) to propose an environmental engineering certificate. This certificate would encourage non-environmental engineering majors to not only take environmental engineering courses, but also have valuable experiences working at facilities through hands-on training. It has become apparent that employers in the Texas Panhandle are employing students in other programs to complete work related to environmental engineering. Therefore, it would be beneficial for graduating students to have foundational knowledge and gain classroom experience in these focus areas prior to employment. By collaborating with local employers, we can foresee a potential reduction in on-the-job training provided by the employer, and a reduction in learning curve for the students.

Electrical Engineering

The electrical engineering program began in Spring 2017 (first faculty hired in Spring 2016) and was initially accredited in 2019, after the first graduates completed the program in 2018. Author Dr. Anitha Subburaj is one of the inaugural faculty members in electrical engineering.

The initiation of the Electrical Engineering program at West Texas A&M University received approval from both the Texas A&M University System and the Texas Higher Education Coordinating Board, allowing it to commence in the Spring term of 2017. As students transferred from community colleges and some completed our Pre-Engineering program, the program successfully saw its first graduates in December 2018.

The program predominantly takes place on campus, utilizing traditional classrooms and laboratories for delivery. While most courses in the core and engineering curricula are conducted in a traditional on-campus format, some are also offered in a web-based format. Students have the flexibility to choose between web-based or traditional classroom settings for those specific courses.

The electrical engineering degree is comprised of various areas of emphasis in addition to the pre-engineering and core course sequences. These courses cover the major aspects of the electrical engineering profession, focusing specifically on the design of power electronics, electric machines, electric drives, and electric power devices.

The electrical engineering curriculum offers numerous occasions for students to demonstrate their effectiveness in teamwork. This involves contributing to leadership, fostering a collaborative and inclusive environment, setting goals, planning tasks, and achieving objectives within a team setting. In design courses, students will engage in developing and conducting experiments, analyzing and interpreting data, and applying engineering judgment to draw conclusions. Students are also mandated to continually acquire knowledge in new technologies, software, and technical standards, ensuring their readiness for lifelong learning. The synthesis of these demonstrated student outcomes equips engineers to exhibit critical thinking, creativity, and leadership in diverse team roles within the industry.

The curriculum's depth extends to include content in essential areas for all engineers, such as ethics, devices, integrated circuits, and engineering economics. The objective is to offer a comprehensive electrical engineering education that serves as a foundation for graduates to specialize in their early professional careers and pursue advanced studies through graduate education.

The College holds annual programmatic assessment meetings every Spring semester. These sessions evaluate the assessment, enabling College administration to make informed decisions regarding resource allocation, faculty recruitment, course revisions, or curriculum adjustments as needed.

Future Directions

The College of Engineering is always striving for continuous improvement to meet pedagogical, accreditation, technological, and industrial needs. At the forefront of immediate changes are the incorporation of digital textbooks as part of an initiative by the university's president to decrease cost while keeping teaching materials up-to-date.

Faculty are working on other technological innovations such as incorporation of AI and online instruction. In particular, the electrical engineering major and engineering master's programs are now deployed in a fully online format.

The nascent master's program is growing beyond the professional non-thesis option to include thesis students performing research at the university campus. The master's program is young, having started in 2016 and has begun to mature as faculty and facilities have been added. Even so, a commitment to undergraduate research opportunities remains and is now supplemented with having master's students to also mentor these students.

The introductory ENGR 1301 Fundamentals of Engineering course continues to evolve. There is now a Pre-Engineering University Program (PUP) that allows for high school student enrollment in this course and other basic general engineering coursework. Dr. Leitch is the lead author of a nationally published textbook for the class that will be revised and expanded with new material and laboratory activities.

Our Fundamentals of Engineering review class is being revamped with help from the Academic Technology department on campus to develop high quality FE topic review videos. The plan is for the videos to have a similar structure as ACT and SAT review videos on YouTube. The College currently offers a series of videos recorded in Fall 2020. This new set of videos will expand on the list of topics currently covered. The first set of videos was recorded in Fall 2023 with plans to continue recording until all programs have a set of updated videos.

Summary and Conclusions

In summary, we have described the development from scratch of mechanical, civil, environmental, and electrical engineering majors in the 21st century for not only the Texas Panhandle region but also for the state of Texas and beyond. We continue to adjust our programs to meet the requirements and challenges of the engineering disciplines.

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ROY J. ISSA

Dr. Issa is a professor of Mechanical Engineering at West Texas A&M University. He holds B.S. and M.S. degrees in Mechanical Engineering from University of Tennessee, Knoxville, and Ph.D. degree in Mechanical Engineering from University of Pittsburgh. Prior to joining WTAMU, Dr. Issa worked four years in the aerospace industry and eight years in the steel rolling industry. He is a co-inventor of a US patent on the rolling of flat products. Dr. Issa's research activities focus on experimental studies in multiphase heat transfer in metal production, power generation, food processing, and on the implementation of nanofluids in heat exchanger systems. He served as a U.S. Fulbright Scholar to Austria in 2016.

ANITHA SUBBURAJ

Dr. Anitha Subburaj is an Associate Professor of Electrical Engineering at West Texas A&M University (WT). She has been named the inaugural appointee to the McFather Professorship of Engineering, Computer Science and Mathematics at WT, 2022. Dr. Subburaj received her M.E. in Applied Electronics from the Anna University in 2007, India and her Ph.D. in Electrical Engineering at the Texas Tech University (TTU) in 2014. She was a post-doctoral research associate at TTU before coming to WT. Dr. Subburaj is a Senior Member of the IEEE society. She teaches electrical circuits design, signals, control systems, renewables, and electric power systems. Dr. Subburaj has several publications in Renewable & Sustainable Energy Review Journal, IEEE Transactions on Industry Applications, and International Journal of Renewable Energy Research. Her research interests include Education research methods, renewable energy, control systems, battery energy storage system, and battery connected to grid applications.

ERICK BUTLER

Dr. Butler is Associate Professor of Environmental Engineering in the College of Engineering at West Texas A&M University in Canyon, Texas. He graduated from Cleveland State University in Cleveland, Ohio with a BS in Environmental Science (2007), an MS in Environmental Engineering (2009), and a Dr. Eng. in Civil Engineering (2013). Currently, he is an Assistant Professor of Environmental Engineering at West Texas A&M University in Canyon, Texas since August 2013. He is an engineering intern in the state of Texas and is a registered P.E. in the state of Louisiana. His research efforts "strategically focused on ways to effectively solve regional water problems in rural regions with a strong emphasis in wastewater." Specifically, he has conducted research on electrochemical and photochemical treatment of wastewater, quantitative assessments of wastewater treatment ponds and playa lakes, and quantification of viruses within rural wastewater networks.