

University Senate Chair Award Nominee Information

Dr. Jun-Ing Ker

Associate Professor and Program Chair

Industrial Engineering

College of Engineering and Science

1. List of Courses Taught and Overall Teacher Evaluation

Academic Year	Fall	Winter	Spring	Average
2022--2023	INEN 408-001 4.0 INEN 421-001 4.0 INEN 511-001 4.0	INEN 401- 001 3.2 INEN 422-001 4.0 INEN 505-V84 3.0 INEN 566-V84 4.0 INEN 566-001 3.0 EMGT 466-V84 3.3		3.6
2021-2022	INEN 408-001 3.7 INEN 421-001 4.0 INEN 511-V84 3.0 EMGT 411-V84 4.0	INEN 401- 001 3.8 INEN 422-001 4.0 INEN 505-V84 2.0* INEN 566-V84 3.5 EMGT 466-V84 3.3	INEN 413-001 3.9 INEN 423-001 3.9 INEN 511-V84 2.8 EMGT 411-V84 3.0	3.7
2020-2021	INEN 408-001 3.1 INEN 421-001 3.3 INEN 511-V84 3.3	INEN 401- 001 3.5 INEN 422-001 2.8 INEN 505-V84 4.0 INEN 566-V84 2.9 EMGT 466-V84 4.0	INEN 413-001 3.8 INEN 423-001 3.7 INEN 511-V84 3.3 EMGT 411-V84 2.8	3.3
2019-2020	INEN 408-001 3.6 INEN 421-001 3.7 INEN 511-V84 4.0	INEN 401- 001 2.9 INEN 422-001 3.4 INEN 450C-001 4.0 INEN 505-V84 3.4 INEN 566-001 4.0 INEN 566-V84 3.3	INEN 413-001 3.2 INEN 423-001 3.7 INEN 511-V84 3.4	3.4
2018-2019	INEN 408-001 3.7 INEN 511-001 3.0 INEN 421-001 3.6 INEN 511-V84 3.5	INEN 401- 001 2.8 INEN 422-001 3.6 INEN 505-V84 3.5 INEN 566-001 4.0 INEN 566-V84 3.2	INEN 413-001 2.9 INEN 530-001 4.0 INEN 423-001 3.7	3.4

*only one student completed the evaluation.

2. Statement of Beliefs Concerning the Importance of Teaching, Research, and Community/University Service to the Overall Mission of the University

Teaching

Engineers make things. Industrial Engineers are experts in finding “better ways” to make things. This fundamental concept was initially developed by Frederick Taylor (also known as the Father of Scientific Management) in the early 1990s when he discovered that there was one best shovel size to handle each type of material (coal, sand, rock, etc.). This gave rise to the discipline of Industrial Engineering, which is widely adopted in various fields as the concept of “continuous improvement.” (Sounds familiar?)

Established in 1954, the Industrial Engineering Program at Louisiana Tech University, one of the oldest programs of its kind west of the Mississippi River, is committed to training graduates with the knowledge and skills necessary to make effective system improvement decisions for their organizations. This educational objective is in line with the University's mission to maintain excellence “as a selective-admissions, comprehensive public university, Louisiana Tech is committed to quality in teaching, research, creative activity, public service, and workforce/economic development”. Since becoming the Industrial Engineering Program Chair in 1996 (after the College of Engineering merged Mathematics, Physics, and Chemistry Programs to form the College of Engineering and Science), I have focused on designing robust curricula for both undergraduate and graduate levels and providing adequate lab equipment to achieve this educational objective.

Although all faculty contribute to designing curricula, I have initiated two innovative approaches. First, I revamped our Capstone Design courses in 1996 from requiring seniors to create plant layouts for producing “virtual products” to solving real-world problems faced by regional industries and organizations. With the support of regional industries, we completed the first six projects in May 1996 and presented them to our industrial sponsors. As of today, our Capstone Design project teams have completed over **one hundred twenty** projects (95% of which were under my direct supervision), resulting in saving more than **four million dollars** for the participants in their first-year implementation of our suggestions. The annual Capstone Design conference judges' assessment data shows that the quality of our senior design projects has continued to improve year after year. This program not only provides seniors with opportunities to make system improvement decisions in real-world settings but also generates funds through sponsorship (approximately **\$40,000** over the years) to support various program functions such as advisory council meeting lunches, senior farewell lunches, and alumni awards. Furthermore, the funds support our lecturers and students to attend the Institute of Industrial Engineers (IISE) regional and national conferences to supplement college funds that can only partially support these activities.

The second innovative initiative took place recently when I began to integrate the freshmen pump project into upper-level industrial engineering courses. In our college, all freshmen engineering students are required to take two fundamental engineering courses, Engineering Problem Solving I and II (ENGR 120 and ENGR 121), in their first two quarters of study. These courses require student teams to fabricate a small centrifugal pump driven by a DC motor, test its performance, and control the temperature and salinity of a small volume of water through a fish tank project. Although designed to benefit all engineering majors, industrial engineering seniors felt that the project-based experience was not directly related to the knowledge learned in their upper-level industrial engineering courses. Starting in 2015, I began to integrate the freshmen pump project into the courses I taught and invited other faculty to do the same if they deemed it suitable. As of today, four industrial engineering upper-level courses (three of them cross-listed with graduate-level courses) have used the freshmen pump project as the learning platform. Three of these courses are taught by me. Specifically, in INEN 401/566 Six Sigma and Quality Control, students are asked to draw a cause-and-effect diagram to show the root causes of low pump efficiency. In INEN 421 Capstone Design I, students brainstorm ways to improve pump efficiency. In INEN 409/517 Work Design (taught by Dr. Mary Fendley), students determine the standard time needed to assemble the pump. In INEN 408/511 Lean Manufacturing and Management Systems, students set up a Kanban production line to fabricate pumps and measure production rates. Assessment results in these courses all show that using a product that students were familiar with helped them connect the concepts learned in classes to real-world applications. These results were published in the 2017 ASEE Gulf South Conference and the 2023 IISE Annual Conference, where one reviewer of this paper cited this curriculum design as innovative.

This pump integration approach serves two purposes. First, it bridges the gap between lower-level engineering courses and upper-level industrial engineering courses. Second, it enables instructors to relate the methods taught in classes to solve problems created by students in their freshman year. For example, questions like “why is the pump's efficiency so low?”, “why were so many errors made?”, “how can you improve it?”, “how many workstations are needed to produce 500 pumps per day?”, “and how quickly can a pump be produced?” can often trigger students' interest. This approach also resembles actual factory operations in which efforts are made to improve the production of a single product or a product family.

As a shepherd of our undergraduate curriculum, I have fulfilled my primary duty while also playing a significant role in developing curricula for our graduate degree programs and certificates. Among these are our successful online MS in Engineering and Technology Management degree program and MS in Engineering degree program with an online industrial engineering concentration. Additionally, I have contributed to the development of the Six Sigma Black Belt (SSBB) graduate certificate and the Lean and Six Sigma undergraduate certificate (LSS). Over the past five years, our MSETM degree, one of the largest graduate degree programs on campus, and MSE (INEN) degree have received top rankings from graduate studies consulting websites such as Best Value Schools, College Rank, and SR Educational Group, earning four and three top rankings, respectively. Three of the courses I teach (INEN 505, IENN 511, and INEN 566) are the core courses for these certificates. As part of our MSETM online degree program, I have

developed a new graduate-level core course, INEN 505 Productions and Operations Analytics. Since its establishment in 2016, 108 graduate SSBB and 22 undergraduate SSBB certifications have been awarded, and four students have received LSS certification since its inception in 2021. Honestly speaking, I am an average teacher in my program that has some of the best teachers on campus. However, I have tried to correlate the events happened in the world to the industrial engineering methods taught in my classes, like President Biden mentioning “lean manufacturing” in his speech as a method to solve the port congestion problems and how the passage of the Infrastructure Bill will help create manufacturing jobs for us. I believe this approach complements what students can learn from textbook examples and homework problems.

Aside from well-designed curricula, there is ample literature showing that engineering students learn better through hands-on experiments. As such, every engineering program faces the challenge of needing to modernize its equipment to stay current with the latest technologies. To meet this everlasting challenge, I have submitted eight equipment enhancement proposals to the State of Louisiana Board of Regents (BoR) since I joined Louisiana Tech in December 1989, and successfully had five of them funded. These five enhancement grants have provided approximately **half a million dollars** for the program to purchase modern equipment and software to support our laboratory development efforts in areas such as robotics and automation, lean manufacturing, industrial ergonomics, and smart manufacturing. This equipment not only helps meet the teaching needs, but also supports the research needs of our faculty. In addition, it can leverage the chance of obtaining other research grants. As evidence, one reviewer cited the availability of modern Industry 4.0 equipment to offer smart manufacturing training to our students as one of the reasons that he recommended the Department of Energy award a grant to Louisiana Tech to establish the **Mississippi, Arkansas, Louisiana, Texas Industrial Assessment Center** (now known as MALT IAC) in August 2021.

Research

The focus of my research at Louisiana Tech initially centered around automated visual inspection, spanning from large to micro scales. During this time, I had the opportunity to collaborate with faculty members from the Institute of Micromanufacturing and utilize their equipment to collect data. However, as I assumed the role of Program Chair and began teaching the Capstone Design course, I shifted my research efforts towards investigating methods to enhance productivity, efficiency, and quality for industries and organizations, an area commonly known as Lean and Six Sigma or continuous quality improvement.

Most of my recent research work in this field has been conducted with undergraduate and master’s degree students in industrial engineering, rather than doctoral candidates, due to the lack of a research center specifically designed for this demographic at Louisiana Tech before the establishment of the MALT IAC in 2021. As a note, I have supervised 1 doctoral dissertation, 20 master theses and 46 master practicums thus far. Despite this limitation, I have published 37 refereed papers with my graduate students, with two articles being highly cited, receiving 77 and 63 citations, respectively. In terms of research funding, I have been awarded over **3.5 million dollars** to date. Recent successes include securing a **\$52,730** equipment enhancement grant from the BoR and two Department of Energy grants, totaling **2.2 million dollars**, where I played a crucial role in coordinating the proposal writing process. This involved assembling a strong research team across four institutions (Louisiana Tech, Grambling State University, University of Louisiana at Lafayette, and Louisiana Delta Community College) and leading the writing of the technical content and economic impact sections. The two DoE grants commissioned the MALT IAC to train undergraduate and graduate students to provide free energy and productivity assessments to small and medium-sized manufacturing enterprises and owners of commercial buildings. My significant contribution to the funding of the MALT IAC led to my appointment as its Associate Director by Dr. Cardenas, the Center's Director. Additionally, in January 2023, Dr. Jason Howell and I submitted a pre-proposal to the Louisiana Transportation Research Center to optimize Lincoln Parish Bus Routing. The pre-proposal received a positive response, and we recently learned that it will be funded in July 2024 at an amount ranging from **\$120,000 to \$150,000** for two years.

Workforce Development

From June 2011 to October 2016, we conducted 65 hours of Lean and Six Sigma training for Midsouth Extrusion and CenturyLink in Monroe, and Frymaster in Shreveport. The coordination of these training programs was led by Mr. David Merchant, who was the Coordinator of Division of Continuing Education

and Distance Learning at the time (may he rest in peace). Dr. Easley, Dr. Cronk, and I were the instructors of these training workshops. In total, we trained 132 employees, and the workshops were funded by the Louisiana Incumbent Workforce Training grants, generating **\$75,905** in revenue for the University.

David had once said, "Through these workforce training partnerships, we made the workforce in our region and state acutely aware of Tech's abilities to provide quality training that applied directly to the workforce skill needs and the betterment of the workforce in general." His absence is deeply felt, and he will always be remembered. Overall, the training workshops were successful in equipping the employees with the necessary skills and knowledge to improve their work performance. The workshops not only benefited the employees, but also contributed to the development of the workforce in the region and state.

Service

At the community level, I have been involved in various service activities, including charity events organized by the Miss Louisiana Organization and other entities. I accompanied my daughter, Justine Ker, Miss Louisiana Outstanding Teen 2011 and Miss Louisiana 2016, to these events, and we raised funds for the Children's Miracle Network Hospitals. Additionally, I have supervised Capstone Design Projects and the MALT IAC energy assessment projects, which have had positive economic impacts on the community. At the university level, I have served as the Program Chair of Industrial Engineering for nearly 27 years. During this time, the program has achieved significant milestones, including being removed from the low completer list of the UL System in 1998, and completing ABET re-accreditations in 2001, 2008, 2014, and 2021, respectively. In the last ABET visit, we received a "no concern" review, which is the highest rating given to a program sought for reaccreditation. The reviewer also commended our well-balanced curriculum as one of our strengths. This accomplishment is a testament to the hard work of our dedicated faculty, administrators, and staff. The program celebrated its 50 years of accreditation in last October, and we received many inspirational messages from alumni and friends, including Dr. Barry Benedict, former Dean of Engineering and now a Professor at University of Texas-El Paso, who stated "you are an asset to Louisiana Tech University", and Justin Garner, former Advisory Council president, "I am very proud of the program and all the hard work that you have invested over the years".

Nevertheless, the most satisfying recognition for me was receiving the University Senate Chair Award nomination. It is the biggest honor I have received in my life, and it has heartened me deeply, especially after my eye doctor announced that I have lost 70% of the vision in my right eye due to glaucoma. However, what truly thrilled me was receiving an "excellent" rating from our students on the quality of education we provide them. For the first time ever, we received a 100% rating (Strongly Agree) from this year's seniors on two questions in senior exit surveys: (1) I am satisfied with the education I received at Louisiana Tech University and (2) I would recommend Tech's Industrial Engineering Program to others. This milestone achievement is attributed to our faculty and administrators who provide needed support to ensure students receive a quality education. In closing, despite my eye condition, I still feel there are important missions to complete. One of these missions is changing the degree offered by our program from "industrial engineering" to "industrial and systems engineering" in the upcoming re-accreditation in 2026. This change will help solve our long-lasting problem of student recruitment by emphasizing that our graduates are capable of making system improvement decisions for enterprises like transportation systems and utility systems, not just industrial factories. To achieve this goal, we will need to refine our current curriculum one more time to meet both industrial engineering criteria and systems engineering criteria. This name change will make it easier for us to recruit prospective students to major in "\$" engineering (who wouldn't?).

3. Selected List of Recent or Relevant Publications, Grants, and/or Presentations (2018-2023)

Publications

Ker, Jun-Ing and Mary Fendley, "Learning with the Pump: Freshmen to Seniors," to appear in Proceedings of 2023 Institute of Industrial and Systems Engineers Annual Conference and Expo, May 20-22, 2023, New Orleans, LA.

Ker, Jun-Ing, Yichuan Wang, M. Nick Hajli, "Examining the Impact of Health Information Systems on Healthcare Service Improvement: The Case of Reducing in Patient-flow Delays in a U.S. Hospital," International Journal of Technological Forecasting & Social Change, 127, pp. 188-198, February 2018 (DOI: 10.1016/j.techfore.2017.07.013)

Invited Talk/Presentations

Panelist, Topic: Career Opportunities in Cybersecurity & Cloud Computing, Cybersecurity & Cloud computing Career Awareness Workshop hosted by Department of Computer Science & Digital Technologies, Grambling State University, Grambling, Louisiana, March 21, 2023.

“Learning with the Pump: Freshmen to Seniors,” to present in the 2023 Institute of Industrial and Systems Engineers Annual Conference and Expo, May 20-22, 2023, New Orleans, LA.

“A Product-centered Industrial Engineering Curriculum,” 2020 Annual Institute of Industrial and Systems Engineers Virtual Conference, November 1, 2020

“Vertical Integration of Courses for Continuous Quality Improvement Education – The Case of Low Efficiency Freshmen Pumps,” 2019 Institute of Industrial & Systems Engineers Lean and Six Sigma Conference, Houston, Texas, September 2019

Grants

Mississippi Arkansas Louisiana and Texas (MALT) Industrial Assessment Center, Topic 2: Commercial Building Assessment Program, Department of Energy Office of Energy Efficiency and Renewable Energy, \$400,000, Co-PI (PI: Henry Cardenas), 1/1/23-12/31/2027

Mississippi Arkansas Louisiana and Texas (MALT) Industrial Assessment Center, Topic 1: Manufacturing Technical Assistance and Energy Engineering Workforce Development, Department of Energy Office of Energy Efficiency and Renewable Energy, \$1,749,767, Co-PI (PI: Henry Cardenas), 10/1/21-09/30/2026

Enhancement of Educational and Research Capabilities to Meet Industry 4.0 Workforce Need, \$52,730, Principal Investigator, Louisiana State Board of Regents, 07/20-06/22.

4. Selected List of Community and/or University Service Activities (last 5 years)

Service to the Profession

Faculty Advisor, Institute of Industrial & Systems Engineers (IISE), Louisiana Tech University Chapter, 1996-present

Session Chair, 2023 Industrial and Systems Engineers Annual Conference and Expo, May 22, 2023.

Reviewer, International Journal of Computers and Industrial Engineering, International Journal of Measurement Science and Technology, 2020 Institute of Industrial and Systems Engineers Annual Conference and Expo, Journal of Symmetry, Journal of Applied Science, Journal of Imaging

Service to the University and College

Tenure and Promotion Committee, College of Engineering and Science, 2023

Chair, ABET Reaccreditation Preparation Team for Industrial Engineering Program, 2020-2021

Mid-term Tenure and Promotion Review Committee, Industrial Engineering Program, 2017-2018

College of Engineering and Science Mentor Program, 2017-2018

5. Other Information

Awards (last 5 years)

Research and Economic Impact COES Award (for establishing the U.S. Department of Energy MALT Industrial Research and Assessment Center at Louisiana Tech University)

CARE Milestone Award, Louisiana Tech University, October 2021 (awarded by Dr. Guice for 31 years of service to Louisiana Tech University), October 2021.

Student Learning & Success Award, College of Engineering Science, Louisiana Tech University, September 2021 (for the leadership provided to successfully complete the ABET reaccreditation visit)

Student Awards (last 5 years)

Three seniors (Wesley Brady, Kosi Anadi, Hayden Scaff) won first place in the Technical Paper Competition at the 2023 IISE Southeastern Regional Conference held at the University of Central Florida, March 22-24, 2023. (The paper was co-advised by Drs. Hegab, Howell and me.)

Research advisor for Landry Seimears, Emily Theriot, and Courtney Wessels who represented Louisiana Tech University at the University of Louisiana System’s “For Our Future Conference 2021”, presenting a research paper based on their senior design project work on March 20, 2021.