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Executive Summary

A. Message from the Department Head

The Department of Industrial and Systems Engineering welcomes the review team to Texas A&M University and thanks you for your service as external reviewers of our academic programs. We are pleased to have this opportunity to assess our academic programs and look for opportunities to continue to improve and enhance them. We realize that strong academic programs, and in particular a strong doctoral program, are a key part of creating and maintaining an excellent department and in establishing and enhancing our academic reputation. Thus, we are grateful for your help in this process.

This self-study report was prepared specifically for this review. It starts by providing the department’s background information, including its history, administrative structure, resources and facilities. In the next two chapters (Chapter II and III), the report presents specifics about our undergraduate and graduate programs, respectively. The program-related content ranges from admission to graduation. More discussion is devoted to the graduate programs, especially the doctoral program, due to the critical role they play at a research university. In Chapter IV, the faculty profile is presented, including faculty research concentration areas, activities being undertaken and their connection with the college’s strategic areas. Chapter V presents the student profile, where the emphasis is on doctoral students but also includes the profiles of both master’s students and undergraduates. In the last chapter, an overview of future plans is provided as direction for our academic programs.

Since the last academic program review in early 2006, the department has experienced significant change. In 2005, the department had 291 undergraduates and 141 graduate students, translating to roughly 22 student enrollments per tenured/tenure-track faculty. That was the second lowest among the eleven departments in the Dwight Look College. Research expenditure from external sources was also the second lowest in the College in 2005. In that same year, the department had roughly a $750K endowment fund. The faculty has been working diligently since. Today, the department has an endowment of $3.7 million, five times the amount in 2005. While having the same number of tenured/tenure-track faculty members as in 2005, the department has 674 undergraduate students and 223 graduate students, more than doubling the student enrollment per faculty, and it is the second highest in the college. The current research expenditure has doubled the 2005 level. While the absolute number in research expenditure is still low when compared with the other departments in the college, the faculty is undertaking various research initiatives, expanding beyond our traditional research boundary and striving to move closer to the college average in this regard.

We, the faculty, sense that the department stands at the doorway of what is to be another period of significant change. Substantial growth in all academic programs is being planned, and new faculty hiring is underway. These hires, in areas ranging from manufacturing systems to human and organizational systems, will appropriately bolster the department’s systems engineering credentials and provide resources for future
initiatives. We look forward to your feedback and await your recommendations about how we might improve our programs as we strive for excellence. We realize this is a time-consuming task and thank you again for your service. We will be glad to answer any questions you might have and provide any additional information you might need.

B. Charge to the Review Committee

Dr. Pamela R. Matthews, Vice Provost, requests that the review team examine the Industrial and Systems Engineering Department and its programs and make recommendations that will help in planning improvements. The resources for this review are a self-study report prepared by the department, copies of materials from the program’s last review, information you gain through personal interactions while visiting Texas A&M University, copies of strategic plans and goal-setting documents at the department, college, and/or university level, and any additional information requested by you or by the department. Within the broad charge of recommending ways the department can continue to improve are some specific questions for the review team to address:

- Based on the data / information provided in the self-study report or gathered by the review team, what are the department’s overall strengths and weaknesses?

- How well do the department’s strategic goals align with those of its college and with those of Texas A&M University?

- How would you compare this department with its national and, where appropriate, international peers?

- What improvements (including student learning and faculty development) has the department made since the previous program review?

- With only current resources or a modest infusion of new ones, what specific recommendations could improve the department’s performance, marginally or significantly?

The Academic Program Review (APR) process at Texas A&M University provides the occasion for academic units to plan strategically, assess the quality and efficacy of their programs, and determine the best courses of action for ongoing improvement. APR is at the heart of our institutional commitment to excellence. Thank you in advance for playing such an important role in this process.
I. Introduction

A. A Brief History

The first industrial engineering courses at Texas A&M were offered in 1918 by Professor E. J. Fermier in the Department of Mechanical Engineering. In 1939, Professor Judson Neff left Harvard University to join the A&M faculty as head of the newly formed Department of Industrial Engineering. Only one student was enrolled during the 1940-41 session. The curriculum for a bachelor’s degree in industrial engineering first appeared in the 1941-42 general catalog. In 1941, Professor Neff returned to Harvard, and Professor Virgil M. Faires succeeded him as the new department head. On Faires’ recommendation, the department’s name was changed to Management Engineering.

Graduate courses leading to a master’s degree appeared in the curriculum in 1943. Management engineering quickly became a popular course of study, with enrollment jumping to 39 in the 1945-46 session. The first graduate degree was granted in 1945 to Hall Hamilton Logan whose thesis was entitled “A Study in the Further Industrial Development of Texas through an Analysis of the Metal Industry.”

Early faculty members who played an important role in the development of the department had extensive experience in industry and were able to impart practical knowledge to students about motion and time study, production engineering, tool engineering, plant design, and personnel issues.

The department received its first accreditation in 1949 from the Engineer’s Council for Professional Development. In 1950, Professor Faires left to join DuPont, and Professor A. R. Burgess was named head. By this time, with the creation of the American Institute of Industrial Engineers, the profession of industrial engineering was gaining stature. So, in 1951 the name of the department was changed back to Industrial Engineering. Throughout the ’50’s and ’60’s the department focused on plant design, industrial processes and quality control.

After the boom in student enrollment caused by the G. I. Bill, Texas A&M in general and the Department of Industrial Engineering in particular experienced a decline. However, enrollment began to rise again toward the end of the ’50’s with an influx of students from the Air Force Institute of Technology (AFIT) who were interested in the developing computer science program. Texas A&M had a new centralized computer center, and the Department of Industrial Engineering assumed responsibility for the computer science teaching program. A master’s degree in computer science was authorized in 1961, and the first degrees were awarded in 1963.

In 1965, A. W. Wortham became department head and launched the department on an era of unprecedented growth, especially the graduate program. He recognized that the profession was changing in scope, and he hired faculty in the areas of human factors, operations research, labor relations, and long-range planning. Under Wortham’s...
direction, the department developed a master’s degree program with the U.S. Army Material Command to train a civilian work force in maintainability engineering. During this time the department also developed graduate programs in safety engineering and industrial hygiene. Research in all these areas began to flourish.

The department obtained approval to offer the doctoral degree in 1967. This was reported to be the first industrial engineering doctoral degree in Texas and in the next seven years, 100 Ph.D. degrees were granted from the department. The doctoral degree in computer science was authorized in 1968 (the bachelor’s degree was approved in 1973). The doctor of engineering degree was first offered in 1974. That degree was designed to produce practicing engineers as opposed to researchers.

In 1972, the discipline of biomedical engineering joined industrial engineering, computer science, and safety engineering in the department. That same year, Paul Newell replaced Wortham as department head. The Master of Engineering and Ph.D. degrees in bioengineering were approved in 1975. Biosystems was another major research area developed in the department in the ’70’s.

In 1975, Newell accepted the position of president at the New Jersey Institute of Technology and Newton Ellis served as department head for the next nine years. Significant growth in faculty, student enrollment, and research funding occurred during Ellis’s tenure. In 1976, a bachelor’s degree in safety engineering was approved. In 1983, the computer science division was given departmental status. Ellis left the department in 1984 to become assistant director for research at the Texas Engineering Experiment Station (TEEX). For the next two years, Leland Blank served as interim head.

In 1986, G. Kemble Bennett was appointed department head. The department continued to grow in size and productivity. In 1987-88, faculty size was 35 and research funding reached $4.5 million. In 1990, the M.S. degrees in safety engineering and industrial hygiene were moved to the Department of Nuclear Engineering.

In 1992, Bennett left the department to become Associate Dean of Engineering and Gary Hogg served as interim head until Way Kuo, the department head at Iowa State University, joined the department in 1993. During Kuo’s tenure, the department size decreased substantially through retirements and when faculty who resigned were not replaced. Kuo was named executive associate dean of engineering in July 2000, and Bryan Deuermeyer was appointed interim head. In Fall 2001, the Division of Biomedical Engineering became the Department of Biomedical Engineering, and in September 2002, Brett Peters replaced Deuermeyer as interim head. In 2003, President Gates announced a faculty reinvestment plan to increase the number of faculty positions university-wide. The College of Engineering was to receive over 100 new faculty positions, and the Department of Industrial Engineering was to receive 8 new positions over the next 4 years. After a national search, Mark Spearman was appointed department head in January 2004. Spearman resigned after six months to pursue business interests, and Brett Peters again served in an interim capacity until his
appointment as department head in September 2004.

Brett Peters served as department head from 2004 through 2011. In 2005, to reflect changes in the nature of industrial engineering, the department once again underwent a name change, to Industrial and Systems Engineering. During Peters’s tenure, the department initially saw an increase in faculty size but later experienced a decrease. By the end of his tenure, the number of faculty was at the level similar to before President Gates’s faculty reinvestment process. César O. Malavé was appointed interim head in August 2011, and after a national search, Malavé was selected and appointed as department head in June 2012.

At the beginning of the fall semester of 2012, 18 tenured/tenure-track faculty members were ad-loc in the department, the smallest in faculty size in a decade. On January 23, 2013, Dean M. Katherine Banks announced her 25-by-25 initiative. It appears that the department stands at the doorway of what is to be a period of substantial growth and significant change.

**Department Heads:**

- 1939-1941  Judson Neff
- 1941-1950  Virgil M. Faires
- 1950-1965  A. R. Burgess
- 1965-1972  A. W. Wortham
- 1975-1984  Newton C. Ellis
- 1984-1986  Lee Blank – Interim
- 1986-1992  G. Kemble Bennett
- 1992-1993  Gary Hogg - Interim
- 1993-2000  Way Kuo
- 2000-2002  Bryan L. Deuermeyer – Interim
- 2002-2003  Brett A. Peters – Interim
- 2004-2004  Mark A. Spearman
- 2004-2011  Brett A. Peters
- 2011-2012  César O. Malavé – Interim
- 2012- pres  César O. Malavé

B. Mission Statement

The Department of Industrial and Systems Engineering’s mission is to serve the state, nation, and global community by educating industrial engineering students to be well founded in engineering fundamentals and to have the knowledge and skills required to design, develop, improve, implement and control sophisticated production and service systems in an environment characterized by complex technical and social challenges. Throughout this educational process, students will be instilled with the highest standards of professional and ethical behavior.
The vision of the Department of Industrial and Systems Engineering is to be recognized as a premier engineering department by demonstrating excellence in research, education, and contributions to the engineering profession. To achieve this vision, we are committed to providing an environment that enhances the intellectual development of the faculty, staff, and students of the department.

The Department of Industrial and Systems Engineering can best fulfill its mission by achieving the following objectives:

• provide outstanding education and research programs in industrial and systems engineering that will attract the best undergraduate students in the state and the best graduate students worldwide;

• attract and retain faculty of the highest quality, and provide them with resources and opportunities to become national and international leaders in their areas;

• furnish undergraduate and graduate students with opportunities to learn and practice the technical, communication, decision making, and management skills necessary to be successful in their engineering careers; and

• foster an environment in which faculty can perform continuing education and public service to their profession, technical societies, and communities, so as to advance their disciplines and to improve the economic well-being and quality of life of the citizens of our state, the nation, and the world.
C. Administrative Structure

Department Head
Dr. César Malavé

Dir. Undergraduate Program
Dr. Rich Feldman

Sr. Academic Advisor
Jeana Goodson

Business Associate II
Michele Bork

IT Staff
Mark Henry
Mark Hopcus

Facilities Manager
Dennis Allen

Academic Business Administrator
Mimi Bowman

Business Coordinator II
Jaime Vykukal

Associate Department Head
Dr. Sila Çetinkaya

Faculty

Dir. Graduate Program
Dr. Yu Ding

Graduate Program Coordinator
Erin Roady

Administrative Coordinator
Cheryl Kocman

Program Coordinator
Andrea Cummings
D. Advisory Council

A department advisory council was established in 1996. Members of the council are leaders in academia and industry, many are former students from the department. The council’s mission is to provide a continuing liaison between the department and the practicing profession for the purpose of improving the quality of the industrial engineering program at Texas A&M University. It assists in resource development and external fundraising to support the department and serves in an advisory capacity to the department head by making recommendations about the department’s goals and programs. The council holds a day-long meeting on campus twice a year. Current membership is listed below (names with an * indicates new membership):

*Ammons, Jane  Chair, Stewart School of Industrial and Systems Engineering, Georgia Tech

*Bellamy, Tandreia  Vice President of Engineering West Region UPS

Clapp, Greg R.  Vice President Business Management Fujitsu Network Communications

Haack, P.E. Michael  Strategic Business Manager Drilling Halliburton

*Heldenfels, Gil  Vice President and General Manager Building Systems Division, Heldenfels Enterprises, Inc.

Hoff, Randy  CEO Cenergistic

Hunter, Victoria L.  Operations Manager, South Texas Branch Stryker Orthopaedics

*Jackson, Marci  Manager, Knowledge Transfer Premier Healthcare Alliance

*Kertz, Jerrie J.  Sr. Vice President, Network Operations AT&T

*LampareroJuan, Manuel  Director General Industrial Solutions Technology de Mexico

*Leath, Kevin  Director of Systems Engineering Boeing Commercial Airplanes

Liollio, Dean  President, PAA Natural Gas Storage, LLC
E1. Facilities

The department operates a number of teaching and research laboratories in the Emerging Technologies Building. Built in 2011, this state-of-the-art facility supports 24/7 card access, video surveillance, several conference rooms with Cisco video conferencing systems, a receiving room, five elevators, and a loading ramp with a hydraulic lift.

Teaching and Computational Facilities

Four separate advanced teaching facilities are maintained by the department. Room 1005 houses 29 Dell Wyse zero client workstations and has a capacity of 58 students. Room 1006 houses 24 Dell Wyse zero client workstations and has a capacity of 60 students. Room 1013 houses 33 Dell Wyse zero client workstations and has a capacity of 66 students. Room 1027 houses 76 Dell workstations with 19" LCD monitors, 3.0 Ghz Quad Core CPUs and 8 GB RAM. It has a capacity of 76 students.

Each of these facilities has a Sympodium® instructor’s console, video camera, projector, room audio and Camtasia® software to record the class session. Audio is also available through a system for the hearing impaired. The recorded sessions can later be streamed for distance learning, flipped classes, or any student wanting to review the class.

For large gatherings and demonstrations, the Demonstration Laboratory in room 3024 is available. This room houses six projectors, and two wall mounted LCD monitors. These devices are connected via a matrix switch to six floor plates with A/V connections. Any plate can connect to any or all devices at once. Audio can also be routed to three different zones. Tables are easily moved into different configurations and for storage.
Seating capacity is 96.

The student computer laboratory in room 3005 supports 50 Dell workstations with 19” LCD monitors, 3.0 Ghz Quad Core CPUs and 8 GB RAM. Printing is handled by two, 62 PPM, LaserJet 600Ms. In addition to the traditional set up of the computer lab, our department also boasts two workstations designed to enable students to gather and share ideas in groups or individually. These workstations contain dual monitors that can be connected to the student’s devices via VGA cables. This allows students to share screens from four different inputs. Café-style tables and chairs, couch seating and a conference table are available for students as well.

The department also has 10 Wyse thin client laptops available for student checkout. If a computer is not available or if the student would like to go somewhere else on campus to study, this laptop can be used to connect back to the ISEN Virtualization Servers. ISEN students have the ability to connect using any mobile device with the Citrix App. They are no longer tied to the computer lab or building to access departmental resources.

Beginning in the spring of 2012, the Industrial and Systems Engineering Department initiated a new offering for students that essentially virtualized our computer lab and since has even virtualized the computer experience within the classroom, collectively known as the ISEN Cloud Computing. All of the major or class-related programs used are now available to students through a web interface or an app on their smartphone or tablet devices. This allows our students to run the particular app from anywhere in the world and anytime they desire on any device. Group meetings where software is needed can now move to any location on or off campus. Full virtual desktops are also available and can provide the same in-classroom experience for local and distance students. The same virtual desktops are used within the classroom thereby making the experience for students seamless. The supporting equipment used for this technology consists of two parts – the main infrastructure and the end user devices.

The main infrastructure is made up of nine Dell R710 servers and two Dell R720 servers that host the various virtual servers and desktops. Additionally, two Dell R610 servers provide redundant provisioning services for our streamed virtual desktops in the classroom. Other supporting equipment are two 48-port network switches, a Dell MD3220 storage array, and a redundant UPS system. For the end user devices, three of our classrooms are using Dell Wyse Xenith Pro zero clients that provide the interface for the users to the cloud-hosted desktops. We also provide ten Dell Wyse laptops in our computer lab for students to checkout and use for up to two days. Much of the end user experience outside of our classrooms and lab are hosted on end user-owned equipment and does not require any high end equipment since the computing power resides in our server room.

The E-studio, located in room 3007, is used as a recording facility for our faculty and students. The equipment in the room can capture anything being displayed on the Sympodium monitor along with audio. The E-studio features a webcam, Smart
Document Camera, screen annotations and a wireless microphone integrated and captured using Camtasia Studio. An HD camera is also available and can be used to capture video inside or outside the studio. A whiteboard is also available for use. The finished recording can then be edited and encoded to multiple different formats depending on how it is to be distributed. Two machines are dedicated to editing, an Optiplex 990 with Camtasia Studio and an Apple Mac Pro with Photoshop and Final Cut Pro.

The Writing Center (3030 ETB) is maintained and staffed by the department with one faculty member and five (the number varies) university certified writing consultants (UWAs) who are industrial engineering majors. The center is equipped with five workstations and space for every consultant and the director to work simultaneously with a student. This writing center provides students with help in their ISEN course writing assignments, teaching instruction in ISEN W courses, assistance to Ph.D. students with a variety of writing tasks, and is a resource for any ISEN student working on professional correspondence (resumes, cover letters, etc.). UWAs are also required to write articles for the department’s various publications and one of them manages the effort.

Research Facilities

The department also supports a number of research laboratories directed by faculty members. The Complex Systems Sensing, Analytics and Informatics (CSSAI) Research Laboratory is located in room 2017 ETB, directed by Dr. Andy Banerjee and Dr. Satish Bukkapatnam. The focus of the lab is to investigate the principles and approaches based on combining process physics, physiology and other domain information with large, diverse streams of sensor data to study the dynamics, modeling, visualization, simulation, sensing and control of complex real world systems. The lab research has led to the development of prediction analytics tools and methodologies for real-time monitoring, forecasting, prognostics and control of nonlinear non-stationary processes, specifically towards addressing quality and health assurance, as well as resource allocation issues in precision and nano-manufacturing systems, cardiovascular and respiratory physiological processes, and other infrastructure and lifeline systems. The lab resources include a passive, non-immersive 3D visualization system driven by an Intel/Windows-based workstation, projectors and a polarized wall-mounted screen, and multiple Intel workstations that support research work in the area of healthcare delivery system modeling and analysis. It will also house a nano-indentation system with an atomic microscope attachment, assorted wireless sensor units, and a white light ultrafine resolution microscope to measure and characterize surfaces and geometries generated from ultra-precision and nanomanufacturing processes. The lab will also contain special fixtures and data acquisition instruments to perform human subject testing to support health assurance related work, primarily for sleep quality monitoring. The lab is supported by several external funding sources at federal (e.g., NSF, U.S. Department of Health and Human Services, NASA, Sandia National Labs) and state (e.g., Oklahoma Department of Transportation, Oklahoma Council of Advancement of Science and Technology, Texas Higher Education Coordinating Board Advanced
Technology Program) agencies, and industry (e.g., Hotels.com, General Motors, Central Rural Electric Cooperative, Association of American Railroads).

The **Advanced Ultra-precision Manufacturing (AUM) Research Laboratory** is directed by Dr. Satish Bukkapatnam and is located in room 2023 ETB. Its focus is on investigating the principles of dynamics characterization and real-time quality assurance in ultra-precision manufacturing processes central to aerospace, defense, automotive, medical (instrument and prosthetics), and microelectronics manufacturing industry sectors, as well as the emerging nanomanufacturing processes. The lab research has led to the development of real-time monitoring and prognostic tools to harness information from vibration, forces, acoustic emission, temperature and optical sensors for *in situ* monitoring of surface finish, and tool condition variations. The lab houses setups for ultra-precision machining (UPM), Electro/chemical mechanical polishing (CMP, ECP, ECMP), finishing of additive manufactured components integrated with wired and wireless sensors. This research has been funded by the U.S. National Science Foundation.

The **Human Factors & Cognitive Systems (HF&CS) Laboratory**, is directed by Dr. Thomas Ferris and is located in room 2024 of the Emerging Technologies Building. The HF&CS Lab is interested in the study of, and design to support human cognitive functions (e.g., attention, information processing, decision making) and performance in sociotechnical engineered systems. In particular, the lab investigates means of supporting attention and task management in demanding multitasking environments (characterized by high workload, stress, and/or time pressure) through novel interface and display design, such as ambient displays and displays that communicate via the sense of touch. Other research involves human-automation interaction and systems-oriented, human-centered technology design. The lab’s research interest and experience is in the domains of medicine (anesthesiology, patient monitoring, neonatal intensive care), military operations (command and control, UV control and operations), and ground transportation. This room is equipped with an STISIM Drive desktop driving simulator with a 30” widescreen monitor and Logitech force-feedback game controller, Two ATC 3.0 Bluetooth-enabled tactile display systems, a modified MindFlex frontal lobe electroencephalography system, a Zephyr Bioharness 3.0 heart rate and heart rate variability sensor system, an IOM skin conductance system, a LeapMotion controller and Arduino microcontrollers with ambient display design kits. Funding sources include National Science Foundation (NSF) Center for Health Organization Transformation (CHOT): Reducing Unnecessary Disruptions of REM Sleep for Pre-Term Infants in Neonatal Intensive Care Units, NSF-RAPID: Identifying Social Network and Mobile Technology Use and Its Correlation with Individual Evacuation Behavior in Hurricane Sandy.

The **Systems Engineering Research and Teaching (SERT) Laboratory** is run by Dr. Lewis Ntaimo and Dr. Andy Banerjee, and is located in room 3004 ETB. The SERT lab provides undergraduate/graduate students focusing on systems engineering a hands-on experience modeling and simulating complex systems. The lab will be available for the research project component of all our systems engineering courses, where students can
design and build system models, and simulate (execute) them in a software/hardware distributed environment that allows for interaction with "real" robotic systems. The lab also enables students to use AVS/Express, a comprehensive and versatile data visualization tool for rapid data analysis and rich visualization techniques combined with a graphical application development environment. This lab space accommodates 15-20 students. Hardware includes 1 Dell OptPlex GX980, IntelCore i7 Quad Core 2.8 GHz Proc with 8GB RAM, Dual Monitors, 11 Dell OptPlex GX980 IntelCore i7 Quad Core 2.8 GHz Proc with 8GB RAM, Dual Monitors Multi-touch simulation visualization monitor, and 1 Intel Modular Server, TBA Processors, TBA GB RAM. Systems Software includes Systems Modeling KBSI AI® WIN® software (IDEF modeling software), IBM Rational Data Modeler, IBM Systems Developer, AVS/Express Visualization Software, DEVSJAVA/DEVS-Suite Modeling and Simulation CPLEX 12.0 and MATLAB. The funding for this lab is provided by the Dwight Look College of Engineering.

The **Logistics and Networked Systems Laboratory** has been established and directed by Dr. Halit Üster and is located in room 3006 ETB. Research activities in the lab relate to effective and efficient design and operation of networked systems that provide consumers with products and services. These activities have three dimensions: effective modeling approaches for efficient design of large scale networked systems, strategic and tactical decision making in networked systems (e.g., supply chains) and efficient optimization methodologies to support these design and decision problems. Drs. Cetinkaya, Moreno-Centeno, and Yates are affiliated faculty members. Affiliated faculty have diverse expertise in logistics, deterministic and stochastic modeling and optimization as well as network optimization and data management utilizing geographical information systems. Sample projects include Optimization Models and Algorithms for Network Design Problems with Applications in Transportation, Telecommunications, and Wireless Sensor Networks, Emergency Response Networks Planning, and Network Design and Inventory Management in Closed-Loop Supply Chains. Funding for this lab has been provided by National Science Foundation, U.S. Department of Agriculture, Frito-Lay, Inc., PepsiCo, and Nokia.

The **Computational Operations Research (CORE) Laboratory** is run by Dr. Lewis Ntaimo and is located in 3017 ETB. The lab focuses on stochastic modeling, optimization, and simulation research for problems characterized by data uncertainties that are of a large-scale nature in several application areas. It also specializes in developing models and decomposition algorithms for large-scale stochastic optimization problems, performing large-scale computations to solve the problems, and running simulations to validate the models and algorithms. Currently this lab has seven students, 13 workstations and a DELL PowerEdge Server. The CORE lab brings visibility to the department by attracting sponsored research, the best Ph.D. students, as well as collaboration with industry. It provides an environment for students to work on their research projects in a team setting and computation resources for large-scale memory intensive and computer intensive problems. The sources of funding for this lab are National Science Foundation and U.S. Auto Logistics.

The **Discrete Optimization Laboratory** is directed by Dr. Kiavash Kianfar and is
located in 3017 ETB. The research in this lab is on theory, computation and application of optimization problems involving decisions of discrete nature. Such problems arise in numerous application ranging from manufacturing to bioinformatics. Developing faster algorithms for discrete optimization problems and novel applications of discrete optimization modeling in big data are the major research trusts in this lab. Theory and computation of cutting planes in integer programming, discrete optimization algorithms in bioinformatics and genomics, service coverage problems, sensor network reliability analysis, and emission reduction in transportation are some of the active research areas in this lab. Recently, the lab has started collaboration with Veterinary School on cutting-edge big-data/optimization problems in genomics including problems arising in microarray and next-generation sequencing data analysis. The lab has 4 computer workstations equipped with several software packages. National Science Foundation and Air Force Office of Scientific Research have been sources of funding for this lab.

The **Laboratory for Energy-Sustainable Operations**, located in 3021 ETB, is co-directed by Drs. Natarajan Gautam, Andrew Johnson, Lewis Ntaimo, and Yu Ding. The lab’s mission is to perform leading edge research in the field of energy-sustainable operations and disseminate resulting technology through education. The researchers along with their students are engaged in managing risk, uncertainty and variability in production and consumption of energy. The laboratory focuses on the two key drivers of energy-efficiency, namely, (1) innovation in production and distribution of energy, and (2) creativity in resource management to reduce energy consumption. Research topics include reliability and maintenance of wind farms, pricing and energy markets, electricity distribution regulation, European energy market and transmission network modeling, pollution abatement in power generation, data center energy efficiency, energy-performance tradeoffs in wireless networks, and controlling production-systems energy consumption. The laboratory is engaged in research projects that are funded by NSF, National Oilwell Varco, Aalto Foundation, and AFOSR.

The **Advanced Metrology Laboratory**, directed by Dr. Yu Ding, is located in 3022 ETB. This lab houses a Sheffield Discovery-II D8 high-resolution CMM, a LDI Surveyor DS-2020 3D Optical Scanning CMM, and three dual-CPU and quad-core computer workstations, and a number of office desktop computers. Research projects have been supported by the National Science Foundation, Air Force Office of Scientific Research, Department of Homeland Security, Institute of Applied Mathematics and Computational Science, and the state of Texas Advanced Technology Program and Advanced Research Program.

### E2. Finances

The Industrial and Systems Engineering Department (ISEN) is supported by state appropriated funds, student fees, sponsored research income, grants and gifts. The dean of engineering determines ISEN’s portion of the state appropriated funds. These funds are known as our Gold Plate Budget (GPB) and are based on historical statistics, new authorizations such as from the Dean’s Special Merit Fund, faculty and staff merit increases, and any announced adjustments. ISEN also receives a historically set
amount of operating funds from the Dean. Other sources of income include student fees, indirect cost returns based on sponsored research expenditures, externally (industry and federal) and internally (state, agency) funded grants and gifts. Gifts are received from individuals and corporations; some of these gifts are endowed and produce monthly income.

Expenditures include faculty and staff salaries, faculty travel and professional activities, general operating expenditures (e.g. phone bills, copy machine/paper/office supplies, computer supplies), graduate student support, student projects and travel, classroom and laboratory equipment purchases and maintenance.

E3. Endowment

While records show a few efforts to grow an endowment (mainly scholarships) prior to 2000, there seems to have been little concerted and consistent effort to establish a solid, long-term relationship with the department’s former students. During Brett Peters’s tenure as department head, the endowment steadily increased. Peters was successful in securing a number of Faculty Fellowships and Career Development Professorships for supporting and recognizing junior and mid-career faculty members. In 2011, the department received a $2 million endowment from W.M. “Mike” and Sugar Barnes, which is used to establish the Sugar and Mike Barnes Department Head Chair in Industrial and Systems Engineering. As of now, the department has an endowment fund, totaling about $3.7 million.

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Endowment Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY08</td>
<td>$1,285,092</td>
</tr>
<tr>
<td>FY09</td>
<td>$1,149,134</td>
</tr>
<tr>
<td>FY10</td>
<td>$1,346,075</td>
</tr>
<tr>
<td>FY11</td>
<td>$3,670,853</td>
</tr>
<tr>
<td>FY12</td>
<td>$3,483,607</td>
</tr>
<tr>
<td>FY13</td>
<td>$3,745,218</td>
</tr>
</tbody>
</table>

**Major contributors to endowment since 2008**

- Sugar and Mike Barnes: $2,000,000 Department Head Chair
- Mr. James E. Furber: $100,000 C&J Furber ’64 Fellowship in ISEN
- Mr. Constantine S. Liollio: $100,000 Liollio Family Faculty Fellowship in ISEN
- Mr. John A. Scott: $100,000 Janie and Jack Scott ’73 Faculty Fellowship in ISEN
- Parsons Corporation: $102,000 ISEN Excellence Fund/ISEN Excellence in Teaching/ISEN Excellence in Engineering
F. External Program Accreditations

The department’s undergraduate program goes through ABET every six years. The department undertook and passed the last ABET review in 2010.

G. Last External Academic Program Review

G1. Date: January 29 – February 1, 2006

G2. Responses to Recommendations from the Previous Review

In the final report of the 2006 Academic Program Review, the Review Committee made a 12-point recommendation. The department has provided a one-year follow up response and a four-year status report responding to those recommendations. What follows is a point-by-point response to these recommendations.

**Recommendation 1**: Evolve the structure in the doctoral qualifying exam in terms of course-coverage and uniformly requiring it across the board for all students.

**Response**: Implemented. Previously, students who received an “A” in three qualifying subject courses (ISEN 602, ISEN 622, ISEN 623) could be waived from taking the qualifying exam. The new doctoral qualifying exam requires that everyone must take the exam regardless of their course performance. STAT 611 is not a qualifying exam subject but a required course in the Ph.D. program. The rationale is that the students in our Ph.D. program should receive training in three fundamental areas: optimization (ISEN 622 and ISEN 623), stochastic processes (ISEN 602), and statistics (STAT 611).

**Recommendation 2**: Establish a more structured and proactive mentoring program for
junior faculty.

**Response:** Currently implemented, but not implemented before Fall 2013. After the review in 2006, then Department Head Dr. Peters appointed an ad-hoc committee looking into the junior faculty mentoring issue. The ad-hoc committee recommended a formal mentoring program to be established and devised some of the program’s specifics. However, Dr. Peters never took this recommendation to implementation. The reason is unknown. In the Fall 2013, Associate Department Head Dr. Cetinkaya led the effort of establishing a junior faculty mentoring program. Currently all assistant professors in the department are assigned a senior colleague as their mentor.

**Recommendation 3.** Establish a formal professional certificate program for doctoral students interested in an academic career path.

**Response:** Partially implemented. Subsequent to the review, an ad-hoc Ph.D. placement committee was established, aimed at providing advice and training to Ph.D. students interested in an academic position (e.g., providing mock interviews and rehearsal opportunities). No formal certificate program was established, probably because there have already been a number of similar programs in place within the University, such as the Graduate Teaching Academy, from which several ISEN students are fellows or received certificates. In addition, teaching ISEN 302 (Engineering Economy for non-IE majors) is to provide senior Ph.D. students teaching experience.

**Recommendation 4.** Energize the ISEN Advisory Council to garner more professorships and scholarships/fellowships for the department. Also, increase diversity in their membership and explore non-alumni representation.

**Recommendation 5.** Enhance development efforts (beyond the advisory council involvement) for acquiring endowments for professorships and graduate student fellowships/scholarships, perhaps by hiring a dedicated department development officer.

**Response (to both 4 and 5):** Implemented. Although there remains room for improvement, the department is in much better shape in terms of development and endowment than in 2005. We have a market book value of $3.7 million in our endowment, five times the book value of 2005. The number of professorships and scholarships has accordingly increased. Dr. Malavé, using his endowed chair fund, created two department-level fellowships for graduate students. In general, endowing graduate student fellowships is still a challenge, and needs to be addressed.

Diversity of advisory council members has been increased. We have added four women, one Hispanic and one African American to the council. We also added an aerospace engineer from Boeing. Dr. Jane Ammons, School Chair of ISyE at Georgia Tech, is an academician. Council members are no longer exclusively alumni; for example, Dr. Ammons is not.
The department does currently have a development officer it shares with the ETID department.

**Recommendation 6.** Strategically plan for the direction and growth of the faculty from the viewpoint of impending retirements over the next five years and a resulting predominately junior faculty.

**Response:** Implemented, but the results are complicated. In the eight years subsequent to the last review, from January 2006 to January 2014, the department has hired a total of ten tenure/tenured-track faculty members and Dr. Malavé returned to the ISEN faculty from a previous administrative position. So the net gain is eleven: three at the professor rank, one at the associate professor rank, and seven at the assistant professor rank. Over the same period, two of the assistant professors were promoted to associate professors with tenure.

In the same time frame, the department lost a total of eleven faculty members, due to various reasons, including retirement, volunteer separation, termination and relocation. The eleven losses include six professors, two associate professors, and three assistant professors. One professor and one associate professor hired in the same period chose to take positions at another institute.

The result is that the number of the core faculty does not change (remaining at 20), while the rank composition is indeed different (see chart below). Currently, associate professors are the biggest group, which looks healthier than eight years ago.

<table>
<thead>
<tr>
<th></th>
<th>Full</th>
<th>Associate</th>
<th>Assistant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan, 2006</td>
<td>8</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Jan, 2014</td>
<td>7</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

**Recommendation 7.** Proactively target undergraduate student population and a small focused group of peer institutions for recruiting high quality doctoral students.

**Response:** Implemented. A group of faculty wrote a Graduate Assistance in Areas of National Need (GAANN) proposal to the U.S. Department of Education, which was awarded in 2006. It allowed the department to recruit quality domestic students. We had good successes in finding strong candidates from non-traditional sources like the mathematics department of Abilene Christian University. Three students supported by the GAANN Fellowships graduated from our Ph.D. program and one is about to graduate. Among them, two are African American and two are women.

In addition, the department participated in the Sloan Foundation program and the LSAMP Bridge to the Doctorate Program. Four Hispanic students were supported by these programs. They all graduated and are on faculty of an academic institute (Mendez and Seijo at University of Puerto Rico, Moya at University of Texas - Pan America, Perez at Texas State).
The department heads of the largest ten IE programs (by size) gathered at the 2012 INFORMS Conference in Phoenix to discuss recruiting more students from each other’s undergraduate programs. The department heads agreed to invite directors of graduate programs, or faculty members, from other schools for recruitment visits and to distribute flyers to advocate the uniqueness and complementary nature of individual programs. We sent recruiting flyers to all ten IE programs.

**Recommendation 8.** Continue to explore opportunities for research with local companies and interdisciplinary teams across the university, including the Engineering Technology and Industrial Distribution and the Texas Transportation Institute.

**Response:** Implemented. Over the years, faculty research has indeed become much more interdisciplinary. There are a number of grants received due to interdisciplinary efforts, including collaboration with Electrical Engineering, Geoscience, Health Science Center, Mechanical Engineering, Nuclear Engineering, and Statistics, to name but a few. Some faculty members also explored the opportunities with companies in Texas and received research support from them. Faculty research productivity has increased noticeably: research expenditure from external sources has doubled the 2005 level, and the publication rate also increases from 1.04 journal publication per faculty per year (a five-year average in the 2005’s report) to 1.72 now.

**Recommendation 9.** Re-structure the one-hour seminar course offered to first-year graduate students to have all faculty across the board present their research (perhaps in half-hour slots) so as to expose the students to all areas of faculty research.

**Response:** Partially implemented. The faculty likes to use the seminar series to invite our peer researchers from outside. Doing this exposes students to a broad set of research topics and also increases the department’s visibility. ISEN faculty did present from time-to-time at the seminar course, and this happens more regularly recently, with two to three faculty members presenting in the seminar series every semester. But we agree that it is not as structured as this recommendation suggested. We do have other mechanisms to expose new students to all the areas of research. For instance, the Faculty-Student Interaction Committee is going to experiment with a faculty fair event in the spring of 2014. Participating faculty members will host an information booth, where graduate students as well as senior undergraduate students can talk to the faculty concerning research topics, courses and funding opportunities. Please also cross reference Chapter III, Section I.

**Recommendation 10.** Establish postdoctoral fellowships providing better Ph.D. graduates with an interest in pursuing academic careers additional training beyond the doctoral program to enhance their marketability.

**Response:** Partially implemented. Although the department did not establish a formal postdoctoral fellowship program, the department did provide postdoctoral support to a couple of recent Ph.D. graduates, evaluated individually upon their advisor’s request. Three of them are now on faculty of U.S. academic institutions (Byon at Michigan, Perez...
at Texas State, Moya at University of Texas – Pan American).

**Recommendation 11.** Explore opportunities in emerging arenas such as in healthcare and computational biology, as well as establish a better foothold in more traditional but active areas such as logistics and transportation.

**Response:** Implemented. In additional to the National Science Foundation, the department received grants from Department of Homeland Security, Department of Defense, Office of Naval Research, U.S. Department of Agriculture, Air Force Office of Scientific Research, U.S. Department of Health and Human Services, and the Texas Office of Rural Community Affairs. In addition, ISEN is part of several on-going interdisciplinary initiatives, including the Energy Institute and the National Center for Therapeutics Manufacturing that provides access to additional funding agencies and opportunities. For instance, the College approved in 2012 the certificate for quality engineering of regulated medical technologies, and ISEN involvement is a critical component in that. Please cross reference with our response to Recommendation 8.

**Recommendation 12.** Benchmark the graduate student assistantship stipends at the top ten Industrial Engineering programs in the country, and adjust as necessary the TAMU ISEN assistantship levels in order to be competitive with peer institutions.

**Response:** Implemented. The ISEN assistantship level has been increased several times in the past eight years. The monthly rate of the doctoral student stipend for teaching assistantships is currently $1,700, plus health insurance, benefits, and tuition. The monthly rate for graduate fellowships is between $2,000 and $2,100, plus health insurance, benefits, and tuition. The monthly rate for research assistantships varies, depending on specific faculty research projects, but it must be at or above the level for teaching assistantships. We believe that this level of graduate student assistantship stipend is competitive, considering the relatively low cost of living in College Station.
II. Undergraduate Program

A. Degrees Offered

The department of Industrial and Systems Engineering offers a Bachelor of Science (B.S.) degree in industrial engineering.

B. Degree Plan

<table>
<thead>
<tr>
<th>Freshman</th>
<th>ISEN 101. One-hour ISEN seminar</th>
<th>CHEM 107. General Chem for Engineers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISEN 104. Composition and Rhetoric</td>
<td>ENGR 117. Lab for CHEM 107</td>
<td></td>
</tr>
<tr>
<td>ENGR 111. Foundations of Engineering I</td>
<td>PHYS 208. Electricity and Optics</td>
<td></td>
</tr>
<tr>
<td>PHYS 218. Mechanics</td>
<td>MATH 152. Calculus II</td>
<td></td>
</tr>
<tr>
<td>MATH 151. Calculus I</td>
<td>MATH 151. Calculus I</td>
<td></td>
</tr>
<tr>
<td>HIST. Any US/American History</td>
<td>ENGR 112. Foundation of Engineering II</td>
<td></td>
</tr>
<tr>
<td>KINE 198. Health and Fitness Activity</td>
<td>STAT 212. Principles of Statistics II</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore</th>
<th>MATH 251. Calculus III</th>
<th>MATH 304. Linear Algebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTC 181. Manufacturing and Assembly</td>
<td>MEEN 221. Statics and Particle Dynamics</td>
<td></td>
</tr>
<tr>
<td>CSCE 206. Structured Programming in C</td>
<td>MEEN 222. Materials Science</td>
<td></td>
</tr>
<tr>
<td>ISEN 303. Engineering Economic Analysis</td>
<td>ENGL 210/301. Technical Writing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISEN 220. Intro to Production Systems</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior</th>
<th>MATH 308. Differential Equations</th>
<th>ISEN 314. Statistical Control of Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>POLS 207. State and Local Government</td>
<td>HIST. Any US/American History</td>
<td></td>
</tr>
<tr>
<td>Visual &amp; Performing Arts Elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Senior</th>
<th>ISEN 416. Facilities Location, Layout, Mat Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISEN 459. Capstone Design</td>
<td>ENGR 482. Ethics and Engineering</td>
</tr>
<tr>
<td>Social Science Elective</td>
<td>ISEN Technical Elective</td>
</tr>
<tr>
<td>ISEN Technical Elective</td>
<td>Technical Elective</td>
</tr>
</tbody>
</table>
C. Admissions

Freshman undergraduate admissions are handled centrally by the University Admissions Office. Two categories of applicants are admitted automatically if they submit all required credentials before the capacity limits on admitted engineering freshman are met. The first category of automatic admissions is students enrolled in a Texas high school who rank in the top 10% of their class and have successfully completed all recommended coursework and have successfully met the state of Texas Uniform Admission Policy. The second category is students ranked in the top 25% of their class and achieve a combined SAT math and SAT critical reading score of at least 1300, with a test score of at least 600 in each of these components of the SAT, or a composite ACT score of at least 30 with a test score of at least 27 in ACT math and ACT English and have successfully completed all recommended coursework and have successfully met the state of Texas Uniform Admission Policy. In general, automatic admissions usually fill up the engineering college's capacity. However, 15% of that capacity will be reserved for student evaluations using a more holistic review.

Transfer admissions are done through the department. The department requires that these students have had at least two semesters of calculus and one semester of calculus-based physics. Transfer students are usually accepted if they have at least a 3.0 grade point ratio over their math and science courses as well as at least a 3.0 cumulative grade point ratio.

D. Curriculum

The set of undergraduate courses with a short description regarding each course is available in the appendix as well as in the university catalog found at http://catalog.tamu.edu.

E. Enrollment Statistics and Degrees Awarded per Year

The undergraduate enrollment has grown significantly over the previous ten years and we expect to continue to grow at a rate of approximately 6% per year through 2025. The reasons for the growth are twofold: (1) each year qualified freshman applicants are turned away because the engineering departments have reached their capacity limits and (2) employers indicate a continuing need for additional engineering graduates. Our enrollment and graduation statistics are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall Enrollment</th>
<th>AY Graduations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>252</td>
<td>66</td>
</tr>
<tr>
<td>2004</td>
<td>270</td>
<td>58</td>
</tr>
<tr>
<td>2005</td>
<td>291</td>
<td>63</td>
</tr>
<tr>
<td>2006</td>
<td>380</td>
<td>55</td>
</tr>
<tr>
<td>2007</td>
<td>412</td>
<td>70</td>
</tr>
<tr>
<td>2008</td>
<td>489</td>
<td>80</td>
</tr>
</tbody>
</table>
The academic year (AY) graduation numbers refer to the fall semester of the line shown plus the following spring and summer semesters. For example, there were a total 66 students graduating with a B.S. Degree in Industrial Engineering over the combined semesters of Fall 2003, Spring 2004, and Summer 2004.

<table>
<thead>
<tr>
<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>567</td>
<td>639</td>
<td>646</td>
<td>640</td>
<td>674</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Figure 1. Enrollment numbers of undergraduate students since 2003.

Figure 2. Graduation numbers of undergraduate students since 2003.

Because of the lack of understanding of industrial engineering in most high schools, our enrollment has a significant portion of students transferring from other departments.
within the university after they learn about industrial engineering. Over the past five years, 12% of the undergraduate student body were freshman, 19% were sophomores, 25% were juniors, and 44% were seniors.

Figure 3. Composition of undergraduate students by class.

F. Average Time to Degree

For the 2011-2012 academic years, the average time to graduation was 5.0 years.

G. Placement Statistics

According to the University Career Center, for the Spring 2013 Semester, 66% of our students graduating with a Bachelor’s Degree had job offers, 5% were going to graduate school, and 27% had not yet received a job offer. The average salary for students responding to the Career Center survey was $63,535. During the 2012-2013 academic year, there were 72 companies offering one or more positions to our graduates with the top employers being Cameron Drilling Systems, AT&T, Tenaris, Dow Chemical, Halliburton, Accenture, Cooper Industries, Ecolab, FMC Technologies, HP, Kinder Morgan, Lockheed Martin, and Schlumberger (These are the companies providing multiple offers.) .
Figure 4. Placement statistics of undergraduate students (the statistics do not add to 100% due to rounding errors).

H. Financial Support

The department has limited financial support available to retain undergraduate students and primarily consists of between 20 to 25 scholarships from various donors available for undergraduates. The scholarships are used to provide support to students already in the program who have excelled academically or who have significant financial need.

I. Ranking

For the last 10 years, the department has consistently ranked in the top ten out of 112 industrial engineering departments in the nation. While the rankings are not exactly scientifically determined, they do seem to impact reputation and thus enrollment. The following is the ISEN Undergraduate Program Rankings (overall), as published by *U.S. News & World Report*.

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5th</td>
</tr>
<tr>
<td>2001</td>
<td>7th</td>
</tr>
<tr>
<td>2002</td>
<td>8th</td>
</tr>
<tr>
<td>2003</td>
<td>5th</td>
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<tr>
<td>2004</td>
<td>5th</td>
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<tr>
<td>2005</td>
<td>7th</td>
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<tr>
<td>2006</td>
<td>6th</td>
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<td>2007</td>
<td>8th</td>
</tr>
<tr>
<td>2008</td>
<td>8th</td>
</tr>
<tr>
<td>2009</td>
<td>7th</td>
</tr>
<tr>
<td>2010</td>
<td>7th</td>
</tr>
</tbody>
</table>
J. Academic Enhancements / High-impact Opportunities for Students

The high-impact opportunities for our undergraduate students include the senior design project (ISEN 459), co-op terms, internships, faculty-directed research projects every year through the College's REU program (research experience for undergraduates), including projects in the College of Engineering Aggie Challenge, and study abroad programs, initially in Panama (twice) and recently in Puerto Rico.

K. Assessment of Student Learning Outcomes

Assessment of student learning outcomes is detailed in the 2010 ABET report, which contains a table for each required course. Consider as an example of the measures of the outcomes from ISEN 459 (since that is the final course). The Spring 2010 measures from ISEN 459 for outcomes A – K are 82.2%, 82.2%, 83.9%, 78.5%, 83.9%, 78.5%, 83.9%, 80.8%, 78.5%, 78.5%, and 82.2%, respectively. The evaluation criteria were that students should have at least 80% for all outcomes.

The following improvements were made after 2005

1. Modifications to the laboratory component in ISEN 416;
2. Changing the sequence of courses ISEN 316 and ISEN 424; and
3. Modification in ISEN 424 to convert to W-course (writing component course).

L. Analysis

One important aspect of the undergraduate program is retention. Our retention analysis follows.

The primary data used for this study was obtained from Howdy and the Compass Database (accessed through Argos). The Compass Database used for this analysis included all students in the department as recorded at the end of a semester. Because the data used by the university’s Data and Research Services (DARS) is based on 12th class data, our numbers are not always consistent with the numbers found on the DARS website, but the difference is not significant. It seemed more important to use a consistent data source than to match numbers with DARS; therefore, we assumed the data from Compass was the benchmark.

For modeling purposes, retention is over-simplified and treated as a Markov chain with different probabilities associated with students starting in the fall and students starting in the spring. Based on the Howdy data of enrolled students by semester, the probability that students stay in the same category (namely, U1, U2, and U3) is given as
The probability that students move up to the next category is given as

<table>
<thead>
<tr>
<th></th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>59.6%</td>
<td>45.7%</td>
<td>56.1%</td>
</tr>
<tr>
<td>U2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference between one and the sum of these two probabilities is the probability that students will leave the department. For example, 59.6% of the students who are categorized as freshman during the fall semester will remain as freshman the following spring semester. Also, 28.8% of the students who are categorized as freshman during the fall semester will be listed as sophomores the next spring. Thus, 11.6% of those students will leave the department by the end of the fall semester.

Our seniors graduating number was empirically determined to be 97%, which was established by running the model using various percentages for senior retention starting with the fall semester and ensuring the model totals were approximately the same as the actual totals for the semesters until Spring 2013. Using these probabilities will result in the retention probabilities as follows for students enrolled in the department during the fall semester: 39% of the freshman will eventually graduate, 56.8% of the sophomores will eventually graduate, 76.6% of the juniors will eventually graduate, and 97% of the seniors will eventually graduate.

One critical fact not seen in the above data is that approximately 95% of the students who take ISEN 220 (a key gateway course) will eventually graduate. Thus, a key issue for retention is to focus on the path that leads to ISEN 220. At a minimum the path to ISEN 220 includes the freshman year plus CSCE 206 (or equivalent). Many students will also take STAT 211 and MATH 251 before starting their ISEN courses, so issues dealing with these courses will need to be investigated while developing a good strategy for dealing with retention. Some possible strategies are: (1) using a revamped ISEN 101, (2) designing ISEN 220 and ISEN 303 as gateway courses, (3) bringing ISEN 459 project presentations to ISEN 101, (4) hire a retention/recruitment specialist, and (5) using our student organizations to provide tutoring/support.
III. Graduate Programs

A. Degrees Offered

The Department of Industrial and Systems Engineering offers graduate degrees in two areas: industrial engineering and systems engineering. Degrees in industrial engineering have been offered since the 1940’s and include M.E., M.S. (non-thesis), M.S. (thesis) and Ph.D.

The M.E. in industrial engineering is targeted towards students who desire an advanced degree to prepare them for jobs in industry. The requirements can be met within one year if taking courses from all three semesters, but can be usually met within a year and a half.

The M.S. in industrial engineering typically requires two years of study. The target groups for this degree are students interested in getting a degree to take up positions in the manufacturing and service sectors that require complex analytical and quantitative skills, and those interested in continuing into a Ph.D. program. The two options (thesis and non-thesis) are respectively targeted at students more interested in industrial applications and those more interested in methodological research.

The Ph.D. in industrial engineering can typically be obtained in four to six years. Although desirable, it is not required to start the Ph.D. program after an M.S. The target groups for this degree are students interested in pursuing either faculty positions at other universities or research positions in government and industrial laboratories.

In the area of systems engineering, the department offers a Master of Science degree in Engineering Systems Management (M.S. in ENSM). This ENSM degree targets students with professional background who seek to enhance their knowledge and skillsets with a mixture of engineering and management tools. The degree in systems engineering embraces both IE and non-IE undergraduate students and provides a foundation in systems thinking with an emphasis on integration issues. It provides a flexible curriculum tailored to a student’s interests or the needs of a particular industry. The expectation for these graduates is that they take positions in the manufacturing and service sectors that require systems analysis and design and are also prepared for management and leadership roles within the organization.

B. Degree Plans

B1. Master’s Degrees General Rules

The chair of the advisory committee must be a member of the ISEN graduate faculty. The student’s advisory committee for the Master of Science degree must have at least two additional members; one member being from outside the ISEN graduate faculty. The advisory committee for the Master of Engineering degree does not require additional members. The default advisor for M. E. students is the Graduate Program
Director, though the student may select a different chair if he/she chooses.

Master’s students should submit their degree plans at the beginning of their second semester. Since degree plans are easily changed through petitions, students should not be too concerned about uncertainty regarding specific courses. The Office of Graduate Studies will block students from registering once they have completed 9 hours as a master’s degree student without a degree plan on file.

All master’s degrees have the following required courses: ISEN 609 (probability), ISEN 620 (optimization), and STAT 630 or 610 (statistics). Students can take ISEN 622 and ISEN 623 as a replacement for ISEN 620, and ISEN 602 as a replacement of ISEN 609. ISEN 609 and 620 represent the basic requirements to fulfill a master’s degree, while ISEN 622, 623, and 602 represent the advanced requirements. Students who intend to continue with the Ph.D. program need to take, and do well, in the advanced requirements.

ISEN 620 cannot be used together with ISEN 622/623 on a master’s degree plan. STAT 630 cannot be used together with STAT 610. But ISEN 602 can be used towards a master’s degree together with ISEN 609.

In addition to the required courses, different degree options have other requirements, as outlined below.

**M. S. in IE**

1. The Master of Science Degree – Thesis option must have at least 32 hours.
2. The Master of Science Degree – Non-thesis option must have at least 36 hours.
3. At least 24 hours must be from Industrial and Systems Engineering (ISEN).
4. In addition to STAT 630 or STAT 610, at least one more out-of-department course is required.
5. For the Master of Science Degree – Thesis option, at most six hours of combined ISEN 691 and ISEN 681 are allowed. ISEN 681 is optional, but if used, at most two hours are allowed.
6. For the Master of Science Degree – Non-thesis option, ISEN 681 cannot be used towards a degree requirement. At most three hours of ISEN 692 are allowed.
7. International students on student visas are advised to include up to two hours of ISEN 684 in a degree plan, although those hours cannot be counted towards a degree requirement. Including ISEN 684 in a degree plan is part of the requirements ISS considers when issuing a Curriculum Practical Training document.
8. The ISEN section of some cross-listed courses (ISEN 642, 644, 660) may not be offered to on-campus students. When such courses are
taken as courses from the cross-listed department, they are considered as out-of-department courses.

9. If the independent study course ISEN 685 is used, a course syllabus of the material to be covered for the semester should be developed and given to the administrative coordinator for graduate programs before registering for the class. A letter grade (not an incomplete) will be assigned at the end of the semester. At most three hours of ISEN 685 can be used on a degree plan.

10. At most two non-departmental undergraduate courses at the 300 and 400 levels may be on the degree plan. Such courses must be approved by the department’s director of graduate programs and the student’s advisory committee.

11. Courses (or their equivalent) which are required for admission or ISEN undergraduate courses may not be included on the degree plan. Other courses that are considered as prerequisite material and therefore not allowed on the degree plan are MATH 304, CSCE 601, STAT 601 and STAT 651.

M.E. in IE

1. The total number of hours on the degree plan must be at least 30.
2. At least 18 hours must be from Industrial and Systems Engineering.
3. At least 9 hours must be from departments other than Industrial and Systems Engineering (STAT 630 or STAT 610 is counted as an out-of-department course).
4. ISEN 681 cannot be used towards a degree requirement.
5. ISEN 692 is allowed, up to 3 hours.
6. Students may be exempted from the final exam by submitting a petition to the OGS and obtaining their committee chair’s and departmental approval (must have a 3.0 GPR).
7. to 11. The same as those in Master of Science Degree.

M.S. in ENSM

The objective of the ENSM program is to impart a set of portable tools, concepts and applications that enable students to model, design, and control natural and engineered systems for the benefit of society. The general guidelines follow that of M.S. in IE non-thesis option but with a set of engineering management and business related courses specially tailored for this degree program.

B2. Ph.D. in ISEN

Texas A&M University recognizes two general Ph.D. programs. Students who enter the program directly from a B.S. program have a 96 minimum credit hour requirement. Those students who earn a M.S. degree before entering the Ph.D. program are given credit for 32 hours and hence this program has a 64 minimum credit hour requirement.
The Ph.D. degree is a research-oriented degree for students interested in a career in the academic community, in a consulting field, or in an industrial or service organization interested in advanced training. The research interests of the industrial and systems engineering faculty are diverse and span the typical areas of manufacturing and production systems, operations research and applied probability, systems engineering, as well as transportation systems and applied statistics.

Ph.D. Course Requirements

- **Required Courses:** The following courses are required in the Ph.D. program:
  
  ISEN 602, ISEN 622, ISEN 623 and STAT 611.

A student can petition the ISEN Graduate Committee to exempt all or any of the required courses if the student believes that he/she had taken the equivalent courses elsewhere and can pass the qualifying exams without taking these courses.

In addition to the above four courses, three hours of ISEN 681 are required on a Ph.D. degree plan.

- **Advanced Courses:** At least (3) courses on a Ph.D. degree plan should be from a set of advanced graduate courses.

Each faculty member will have a list of graduate courses he/she (or together with other faculty who share common interests) deems as the advanced course set. A faculty member (or a group of faculty members acting together) should have his/her set of advanced courses on file with the ISEN director of graduate programs, so that the ISEN Graduate Program Office can determine that this requirement is satisfied before a Ph.D. degree plan is approved by the department.

- **Courses Not Allowed:** The following courses will not be allowed on a Ph.D. degree plan:

All undergraduate courses, *except* MATH 409, 446 and 447; Prerequisite courses: ISEN 609, ISEN 620, CSCE 601, STAT 601 and STAT 651; STAT 610 or STAT 630 will be allowed, but *not* both.

Number of Courses Required

Students in the 96-hour Ph.D. program can use up to 51 hours of ISEN 691 towards their degree requirement. This is equivalent to requiring at least 15 regular courses, including three hours of ISEN 681. Requirements for students in the 64-hour Ph.D. program can use up to 31 hours of ISEN 691 towards their degree requirement. This is equivalent to requiring at least 11 regular courses, including three hours of ISEN 681.
Ph.D. Qualifying Exam

Industrial and systems engineering Ph.D. students are required to qualify for Ph.D. study before filing a degree plan. The purpose of the qualifying exam is to assist both the department and the student in determining whether a student can perform at an appropriate level in advanced course work and research to complete the degree requirements.

The qualifying exam is comprised of the following:

- Students will take three, two-hour written exams over the following material:
  1. Stochastic processes (coverage of ISEN 602);
  2. Linear programming (coverage of ISEN 622);
  3. Nonlinear programming (coverage of ISEN 623).

- Students must take all three written exams within one year of entering the Ph.D. program. Students can choose to either take the three written exams all at once, or take a portion of them at a given time, but they must finish all three written exams within a year.

- Students are generally allowed to retake the written exams they did not pass in their first attempt, except that if a student fails all three qualifying exams on their first attempt, then the Graduate Committee has the discretion to deny a student the second attempt and thus dismiss the student from the Ph.D. program effective the next regular semester.

- Students must retake the failed written exams at the next immediate opportunity the qualifying exam is offered.

- Students need a named advisor to fully pass the qualifying exam. Students passing the written portion of the exam but without a named advisor will be given a conditional pass. Under a conditional pass, the student would have a grace period of one regular semester to identify an advisor who is willing to work with her/him (filing the degree plan is preferred to be consistent with the university rule but not required). If the student cannot find an advisor within this time frame, the student will have to appear before the Graduate Committee on a semester-by-semester basis to explain their efforts in finding an advisor. The Graduate Committee will then determine, based on the feedback from the student, whether or not the student is allowed to continue in the Ph.D. program.

Degree Plan

Students are expected to submit their degree plan by the first regular semester after the qualifying procedure has been satisfied. The chair of the advisory committee must be a member of the ISEN graduate faculty. A co-chair, if desired, may be from another
department. The Ph.D. committee has a minimum of four graduate faculty members on the original degree plan with at least one from outside the department.

A Ph.D. degree for a student with a master’s degree requires at least 64 hours, and no courses counted for credit toward the master’s degree can be included in the 64 hours. Transfer courses are acceptable on the degree plan if the advisory committee feels they aid in the degree’s academic objectives; no fixed maximum number of transfer courses has been set by the Office of Graduate Studies. At most three hours of ISEN 685 can be used in the category of regular course hours.

The Office of Graduate Studies will place a registration block on Ph.D. students after 36 hours have been completed if no degree plan has been filed.

Preliminary Exam – Ph.D. Students

The preliminary exam may be scheduled when there are no more than six hours of course work remaining on the degree plan (excluding 681, 684, 691 courses). Students must complete the preliminary exam no later than the end of the semester after completion of all the course work on the degree plan. The Office of Graduate Studies must receive the results of the preliminary examination at least 14 weeks prior to the final exam date.

The exam consists of a written portion given by each member of the advisory committee (members may waive the written portion) and an oral portion.

A student must have a GPR of at least 3.0 over all courses (including 300 and 400 level courses) taken during his/her graduate program as well as a 3.0 over the courses on the degree plan in order to take the exam. All requirements for the Ph.D. must be completed within four years of the exam, or the preliminary exam will have to be retaken. (This four-year limit is measured from the time when the preliminary exam is passed to the time when the thesis clerk in the library approves the dissertation.)

There are three possible outcomes:

1. The student passes,
2. The student passes but some additional requirements are added to the student’s program to overcome a weakness uncovered during the exam, or
3. The student fails.

If the exam is failed, it can be repeated one time, with the graduate committee’s recommendation. All portions of the written exam must be passed before the oral exam is administered.

If circumstances arise where a committee member cannot attend the exam, the committee member should find another graduate faculty member willing to serve as a substitute. Substitutes are almost always permitted as long as there will be only one
committee member absent, and the member absent is not the chair.

Proposal Presentation

The industrial and systems engineering department requires a formal presentation of the proposal. The proposal presentation can take place after the student has passed the preliminary exam. But at the discretion of a student’s advisory committee, students can take the oral portion of the preliminary exam and deliver their proposal presentation at the same time.

If the proposal presentation takes place after a student has passed his/her preliminary exam, the non-departmental members of the committee are not required to attend the proposal presentation, but they should be invited. Under all circumstances, all committee members must sign the proposal before it goes to the Office of Graduate Studies. The approved proposal must be submitted to the Office of Graduate Studies at least 15 working days prior to the submission of the Request for the Final Examination.

Publication of Research

Work leading to the Ph.D. is designed to give the candidate thorough and comprehensive knowledge of the chosen professional field and training in research methods. With the help of the student’s advisory committee, the student must prepare a paper for submission to a professional journal before being considered to have finished the degree requirements. In addition to successfully completing the degree plan coursework, students are expected to present their dissertation research in an ISEN 681 seminar, INFORMS student chapter seminar, or at a national conference. The student must also submit a research manuscript to a refereed journal before graduating. The student’s seminar should be scheduled before the final defense is scheduled.

Final Exam

The final exam for a Ph.D. student includes an open (public) presentation of research results and a closed examination of the dissertation. The final exam needs to be scheduled and copies of the dissertation – approved by the chair – must be provided to the committee at least two weeks before the exam. The copies of the dissertation given to the committee should be the final form. It is also a good practice for a student to keep the committee informed of his or her research progress so that guidance is provided continually instead of as a surprise during the final exam. We also suggest that the student take a copy of the dissertation given to the committee to the thesis office in the library and have a “rough draft conference” with the thesis clerk. The thesis clerk encourages such conferences, and it is usually very helpful in avoiding problems later. It is the student’s responsibility to find an acceptable time for the committee to meet. After a time has been agreed upon by the committee members and a meeting place determined, the student should contact the ISEN Graduate Programs Office for preparation of the final examination paperwork. The graduate program coordinator will also prepare an announcement for the public presentation. The OGS will send the
graduate program coordinator notification that the exam is permissible and will include the form that must be returned after the exam. Since the final exam includes the formal public presentation of the dissertation research, it must be publicized throughout the department.

A student must have a GPR of at least 3.0 over all courses (including 300 and 400-level courses) taken during his/her graduate program as well as a 3.0 in the courses on the degree plan in order to take the exam. All courses on the degree plan must have been taken within 10 years of the final exam. Also, the dissertation must be accepted by the thesis clerk in the library within one year of passing the final exam.

If circumstances arise such that a committee member cannot attend the exam, the committee member should find another graduate faculty member willing to serve as a substitute. Such requests are almost always permitted as long as there will be only one committee member absent and the member absent is not the chair.

C. Admissions

The Texas A&M System’s interpretation of Texas House Bill 16414, results in these admission rules:

- GRE scores cannot be used as the principle reason for denying admission to domestic students.

- Only the GRE verbal score can be used to deny admission to international students. The Texas A&M University standard is a minimum of 400 on the verbal or an offsetting TOEFL score of 550 or above (80 internet-based score).

Thus, for admission to our graduate programs, the principle factors that influence the admission decision are the grade point ratio (GPR) over the last two years of undergraduate study, grades in any graduate courses taken, grades in mathematical and engineering related courses, reputation of the institutions of previous academic work, letters of recommendation and, as a secondary factor, the GRE scores.

To offset the restriction on GRE scores, we pay particular attention to the grades obtained in calculus, differential equations, linear algebra, and statistics as indicators of a student’s ability to perform in our graduate program. Substandard scores in these courses will offset even a high GPA in their last 60 hours of coursework. It is felt that the fundamentals of our graduate program rest on the student’s mathematical and statistical capabilities. Of course, students who did not perform well in these early courses but have shown that they have turned their educational motivation around and have solidified their mathematics training with more advanced courses will not be denied based only on their performance in early mathematical sciences courses.

For the master’s program admission, we use a GPR standard of 3.0 on their last 60
hours of undergraduate coursework. For admission to our Ph.D. program, we use a 3.5 master’s degree grade point standard. In recent years, we have had an increasing proportion of students who have entered the Ph.D. program directly after graduating with a B.S. degree. For this category, we expect their GPR and mathematical sciences courses grades to be nearer to the 3.5 standard, although no particular cutoff point has been established. Students in the B.S. to Ph.D. category appear to be more variable in their performance. We believe that some students may have been forced to make this commitment due to graduate programs across the country providing funding support mainly to Ph.D. students.

International Ph.D. students must pass all sections of the English Language Proficiency Exam (ELPE) within one year of entrance into our program, otherwise they are required to take and pass the corresponding English Language Institute (ELI) courses. A university rule requires that any graduate student being used as a TA (Graduate Assistant Teaching – GAT) for labs or as a course instructor must be ELPE certified.

The average entering GRE scores for all students from the fall semester of the last six years are given below. These are also broken out by verbal and quantitative scores (old format).

<table>
<thead>
<tr>
<th>Year</th>
<th>GRE-V</th>
<th>GRE-Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>560</td>
<td>756</td>
</tr>
<tr>
<td>2009</td>
<td>483</td>
<td>767</td>
</tr>
<tr>
<td>2010</td>
<td>512</td>
<td>771</td>
</tr>
<tr>
<td>2011</td>
<td>514</td>
<td>755</td>
</tr>
<tr>
<td>2012</td>
<td>512</td>
<td>745</td>
</tr>
<tr>
<td>2013</td>
<td>498</td>
<td>763</td>
</tr>
</tbody>
</table>

Prerequisites

Prerequisites into our graduate program (both master’s and Ph.D.) are the following:

- Engineering Economy
- Mathematics: Multiple-dimensional Calculus, Differential Equations, Linear Algebra
- Engineering Mechanics or Calculus Based Physics
- Calculus Based Probability and Statistics
- Scientific Computer Programming
- Deterministic Operations Research
- Stochastic Operations Research

These courses may be taken after admission, but they cannot be counted as credits towards their graduate degree. It is generally recommended that any prerequisites be taken as soon as possible because of the prerequisite structure of most graduate courses.
From the Master's to the Ph.D.

Students in a master’s program at Texas A&M University who wish to enter the Ph.D. program must submit a Letter of Intent that can be downloaded from the Office of Graduate Studies (OGS) web site located at http://ogs.tamu.edu. In addition to the Letter of Intent, the student should also submit a Statement of Purpose and ask his/her advisory committee members to write letters of recommendations. Students transferring from another department should also ask their department to send a copy of their academic file to the Industrial Engineering Graduate Programs Office. To be accepted into the Ph.D. program, the department requires students to have at least a 3.5 graduate GPR as well as positive letters of recommendation, reasonable GRE scores, and previous academic work consistent with the desire for a Ph.D. in industrial engineering.

D. Curriculum

All courses offered at the graduate level are 600-level. The set of graduate courses with a short description regarding each course is available in the appendix as well as in the university catalog found at http://catalog.tamu.edu.

E. Enrollment Statistics and Degrees Awarded per Year

The fall semester is the major influx semester, so we have included the enrollment figures for the fall semester from 2008 through 2013.

Table 1. Enrollment of the graduate programs

<table>
<thead>
<tr>
<th>Degree Offered</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEng - ISEN</td>
<td>82</td>
<td>99</td>
<td>99</td>
<td>83</td>
<td>74</td>
<td>86</td>
</tr>
<tr>
<td>MS - ISEN</td>
<td>105</td>
<td>91</td>
<td>94</td>
<td>83</td>
<td>86</td>
<td>76</td>
</tr>
<tr>
<td>MS - ENSM</td>
<td>39</td>
<td>45</td>
<td>32</td>
<td>16</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>PhD - ISEN</td>
<td>65</td>
<td>78</td>
<td>68</td>
<td>63</td>
<td>56</td>
<td>47</td>
</tr>
<tr>
<td>Totals</td>
<td>291</td>
<td>313</td>
<td>293</td>
<td>245</td>
<td>230</td>
<td>223</td>
</tr>
</tbody>
</table>

The degrees awarded from the ISEN graduate programs are listed in the following table.

Table 2. Degrees awarded by the graduate programs

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MEng - ISEN</td>
<td>41</td>
<td>65</td>
<td>71</td>
<td>85</td>
<td>72</td>
<td>45</td>
</tr>
<tr>
<td>MS - ISEN</td>
<td>10</td>
<td>20</td>
<td>17</td>
<td>23</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>MS - ENSM</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>17</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>PhD - ISEN</td>
<td>10</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Totals</td>
<td>67</td>
<td>103</td>
<td>106</td>
<td>133</td>
<td>104</td>
<td>89</td>
</tr>
</tbody>
</table>
F. Average Time to Degree

F1. Master's Degree Timetable

With the 30 hour M.E. program, students could complete this degree in one year by taking 12 hours each major semester and 6 hours during the summer session. But it is more reasonable to complete it in eighteen months (three regular semesters).

We have recently emphasized a program for our undergraduate students, called the fast track, that allows them to take a graduate course or two during the last year of their bachelor's degree program and double count these hours; the hours count on the B.S. degree usually as examination earned credits and on their graduate degree for credit for those requirements as well. With the fast track approach, it is very reasonable to complete the degree within one calendar year (possibly even including a summer internship). The final oral exam for this degree can be waived by the committee (standard procedure).

The M.S. 36 hour non-thesis program is more suited to an 18-month to two-year length of study. With a standard load of 9-10 hours per semester, it is difficult to complete this program in less than three regular semesters.

Considering also the distance learning students, who usually take a lighter load per semester than the on-campus ones, and thus takes a longer time to graduate, the average time to graduation in our master's programs is 2.6 years.

F2. Ph.D. Degree Timetable

Based on the data of graduations in AY 2008 – 2012, the average graduation time for an ISEN Ph.D. student is 17 semesters (counting summers), which translates into 5.7 years (assuming three semesters a year). The median is 16 semesters. The shortest graduation time is 10 semesters (3+ years) and the longest is 30 semesters (10 years).
G. Financial Support

The department has limited financial support available to recruit and retain excellent graduate students. These funds are supplemented, where possible, by competitive scholarship and fellowship funds made available by the university. Because of the limited funds, two principles direct the use of departmental funds. First, priority for assistant funds will be given to students applying to the Ph.D. program rather than those applying to the M.S. or M.E. programs. Second, the department will generally grant admission only to those Ph.D. students for whom financial support is offered or who have secured external funding.

Each faculty member can request a teaching assistantship allocation and use it to recruit a new student fitting to his/her research program. Faculty members with external research funds are encouraged to review records of top-ranked applicants as candidates for research assistantships. The department submits its top candidates for highly competitive University Merit Fellowships and Diversity Fellowships, and usually receives two to five of these lucrative fellowships per year.

Once an offer is made, students are contacted by individual faculty members, or members of the Graduate Recruiting Committee, and encouraged to enroll at Texas A&M. If a student declines our offer, based on how many students have accepted, an offer may be made to another student on our recruiting list. Each spring, the university supports on-campus visits for domestic students whom we are actively recruiting. The department also supports visits by a limited number of recruits. These on-campus meetings and contact with the faculty appear to be our most effective recruiting tools.

Enrolled master’s students, particularly graduates of foreign universities, often find financial support through departments other than Industrial and Systems Engineering, either as research assistants, teaching assistants, or student workers.

H. Ranking

The following is the ISEN Graduate Program Rankings (overall), as published by U.S. News & World Report.

- 39 -
2011 – (no ranking, due to a data error by *US News & World Report*)
2012 – 10th
2013 – 12th

I. Academic Enhancements for Students

One major aspect in educating Ph.D. students is to train them to write scientific papers professionally. Faculty advisors play a crucial role in this mission. Toward that objective, the ISEN Writing Center plays an important role in helping students, especially those whose native language is not English, to write professionally. For more details about the Writing Center, please refer to Chapter I, Section E1.

To prepare our Ph.D. students for future academic jobs, we set aside sessions of ISEN 302 (Engineering Economy for non-IE majors) for senior Ph.D. students to gain teaching experience. A Ph.D. student, upon request from his/her advisor and assuming that he/she satisfies the English Language Certification requirement, will be given full responsibility in teaching one session of ISEN 302. Our exit interview with recent Ph.D. students shows that students appreciated teaching ISEN 302 as a valuable experience.

The departmental seminar series invites on campus and external speakers, presenting state-of-the-art research and exposing the graduate students to the research topics and activities at the frontier of our field.

The INFORMS Student Chapter organizes a student presentation competition before the annual INFORMS conference. All students who are going to present at the INFORMS conference can get rehearsed and receive feedback before they go to the conference. Top performers in the competition also receive a prize.

Faculty-Student Interaction Committee, or previously, the Ph.D. Student Placement Committee, organized a number of workshops and faculty panels to advise students on job perspective and job market strategies. The department also sponsors student-faculty luncheons, which provides a casual circumstance for students and faculty members to interact.

The Graduate Teaching Academy (GTA) is a graduate student-led organization supported by the TAMU Office of Graduate Studies and the Center for Teaching Excellence. This is a great resource for graduate students to seek help in terms of professional developments. Many of our Ph.D. students attended their workshops and seminars, and a few of them are named GTA Fellows or Senior Fellows. GTA program participants need a faculty member, other than one’s own academic advisor, as their GTA mentor. Upon request, ISEN faculty always serves in that capacity willingly and enthusiastically.

In the Fall 2013 semester, the dean’s office provided grants to the ISEN department to improve the graduate program climate and quality. The Faculty-Student Interaction Committee, together with INFORMS Student Chapter, proposed the following activities
to enhance the graduate program climate and quality:

- **Graduate Student and Faculty Relationships (GSFR) Workshop:** This is to organize a one-day GSFR workshop at the Texas A&M University College Station campus. The GSFR workshop will address topics that include student mentoring, ethics, student/advisor expectations, and conflict resolution. The plan is to invite experts who specialize in graduate student and faculty advisor relationships to speak at the workshop.

- **Capstone Graduate Project Program:** This is supposed to be a student-initiated and student-driven activity targeting master’s students. The plan is to partner graduate students with companies in industry to address real-world consulting problems. A competitive application process will identify teams of five master’s students, supervised by a Ph.D. student, to work with these companies. As part of the project wrap-up and information dissemination phase, one student from each team will be asked to present at the ISERC annual conference next year.

- **Organize a faculty fair for senior undergraduates and graduate students:** Faculty members will host a table/booth at the faculty fair mimicking the format of a career fair. During a two-hour time frame, senior undergraduates, master’s students and Ph.D. students will be invited to visit faculty and discuss research, courses, and funding opportunities.

The proposed activities are to be funded by the OGS through the College of Engineering. The proposed activities will be carried out in the next one or two semesters.

**J. Assessment of Student Learning Outcomes**

The learning objectives and outcomes are documented at a university-wide assessment website known as *Weave Online*; please also refer to the appendix.

The assessment of master’s students learning outcomes is primarily carried out through examinations. In addition to tests in regular courses, all the master of science students are required to go through a 2-hour final exam with his/her committee. In principle, the master of engineering students have the same requirement but are allowed to waive their final exam if their cumulative GPR as well as their degree plan GPR are above 3.0.

The Ph.D. students go through a much more rigorous assessment process. The details are given in Chapter III, Section B2. Generally speaking, the Ph.D. students’ assessment has the following components: (a) regular course assessment; (b) Ph.D. qualifying exam; (3) preliminary exam; (4) dissertation proposal; and (5) final exam (including dissertation defense).

The assessment of student learning outcomes is entered annually (in the summer of each year) through *Weave Online*. 

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K. Analysis

Our admission data show that we are able to attract high quality applicants, but our placement performance, especially placement in the peer institutes, does not meet our own preference. We had limited successes, and it appears that we should have done better. For more details of our Ph.D. student placements, please see Chapter V, Section A9.

In the past year, the Graduate Committee was charged with addressing a number of issues concerning our Ph.D. program, including both the placement issue and the time-to-graduation issue. It appears that our Ph.D. students would take, on average, close to six years to graduate, even if they had a master’s degree when they entered. The Graduate Committee believed that making students identify their research advisor earlier on and having them start their research as early as possible could potentially shorten the average time to graduate. Doing so may also enhance a student’s academic records upon graduation (thereby increase their chance of being placed). Toward that goal, the Graduate Committee proposed, and the faculty later approved, a number of revisions to our Ph.D. program that are briefly summarized below.

1. Pair the students with faculty advisors. Nearly half of the Ph.D. students are supported by the department through teaching assistantship (TA). Previously new students on TA may take up to two years to find their advisors, thereby delaying the start of their dissertation research. A new TA funding mechanism is adopted and gives the faculty member the flexibility to identify students they would like to support with their TA allocation. Consequently, a student on TA support, just like a student on RA support, is paired with their advisor as soon as they enter the program.

2. Lower the number of required regular courses for students who do not have a master’s degree. Previously the number of required regular courses was twenty. If a student takes three courses per semester, finishing twenty courses requires seven regular semesters, or 3.5 years. This number of required regular courses is lowered to fifteen, and as a result, finishing them can be one year quicker (namely 2.5 years). The Graduate Committee looked at the data from our peer institutions. The previous 20-course requirement puts this ISEN department at the very top in terms of the number of courses required. The new 15-course requirement is at the median among our peers.

3. Make a Ph.D. student conditionally pass his/her qualifying exam if he/she does not have an identified research advisor at the time of passing the written portion of the exam. Again, this new requirement reminds students to identify their advisor as soon as possible, once they enter the Ph.D. program.

4. Allow Ph.D. students, at the discretion of their dissertation committee, to take the preliminary exam and proposal exam at the time. Taking the two exams at the same time is already a common practice in many other engineering departments.
at Texas A&M. Previously, although never explicitly prohibited, this department’s common practice was to ask students to take the exams sequentially. The new rule simply reminds the faculty and students that they can do these two at the same time, if the student’s dissertation committee agrees.

The ISEN faculty approved the above changes to the Ph.D. program in April 2013, and we will collect data to assess whether the new practice will produce positive outcomes.

One challenge we are facing is the recent downsizing of our Ph.D. program from close to 70 students in 2010 to be under 50 students in 2013. The downsizing can be largely attributed to the reduced number of teaching assistants supported by the department. In 2010, the department supported nearly 40 TAs, doubling what the department supports now. As a result of the smaller Ph.D. program, the faculty finds it difficult to offer specialized, in-depth Ph.D. level courses, especially after the college has recently increased the number of students required for a graduate course to make from 5 to 8. Our Ph.D. program size is expected to stay flat for the next couple of years, before it can start increasing again. With the new faculty hires and an anticipation of increase in research productivity, we expect the Ph.D. program to be over 65 students by 2018.

Concerning the master’s programs, based on students’ exit surveys, we understand that while they were satisfied with the overall quality and rigor offered by the program, the students wish to see a broad set of courses offered, covering knowledge and skills that are more directly linked to industrial practices. On the faculty side, the faculty is somewhat concerned about doing that with a potential doubling in size of our master’s programs; how we could effectively attract qualified students and manage and deliver the curriculum? It becomes obvious that our current online program (distance learning) will have to be increased substantially, and consequently, account for a significant portion of our master’s programs. Currently we have roughly one-sixth (16%) of our students in the online program. The expectation is that the online program could increase to take 50% of all students in master’s programs in the next five years. Achieving that goal will require some rethinking of our program’s objective as well as making changes to our current curriculum to meet the new challenges. Addressing these issues is the new charge to, and an ongoing task of, the AY 2013-14 Graduate Committee.
IV. Faculty Profile

A. Core Faculty (defined as full-time, tenured and tenure-track, ad-loc to ISEN)

A1. Number

The ISEN department’s number of the core faculty is 20 as of the Spring 2014 semester. The distribution of academic rank is shown in Figure 5 below.

![Figure 5. ISEN current faculty composition](image)

The core faculty size in the past decade is illustrated in Figure 6.

![Figure 6. Core faculty count as of September of each year for 2004 – 2013](image)
A2. Core Faculty/Student Ratio

The number of students per faculty, as of the beginning of Fall 2013, is listed in the following table.

<table>
<thead>
<tr>
<th></th>
<th>PHD to TTF</th>
<th>Master to TTF</th>
<th>Undergraduate to TTF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.4</td>
<td>9</td>
<td>34</td>
</tr>
</tbody>
</table>

A3. Scholarly and Professional Activities

The ISEN faculty actively engages in nationally recognized research. The faculty publishes broadly in various technical journals reputable in the industrial and systems engineering profession. The faculty also regularly presents their work at national and international conferences and at the invited seminars of peer institutions.

Table 3. Journal publications (total and FTE) in the past five years

<table>
<thead>
<tr>
<th></th>
<th>Total # journal publications</th>
<th># journal publications / FTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>39</td>
<td>1.77</td>
</tr>
<tr>
<td>2009</td>
<td>15</td>
<td>0.71</td>
</tr>
<tr>
<td>2010</td>
<td>49</td>
<td>2.23</td>
</tr>
<tr>
<td>2011</td>
<td>40</td>
<td>2.00</td>
</tr>
<tr>
<td>2012</td>
<td>34</td>
<td>1.89</td>
</tr>
</tbody>
</table>

Table 4. Presentations at national/international conferences (total and FTE)

<table>
<thead>
<tr>
<th></th>
<th># Conference presentations</th>
<th># Presentations / FTE</th>
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</thead>
<tbody>
<tr>
<td>2008</td>
<td>37</td>
<td>1.68</td>
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<tr>
<td>2009</td>
<td>29</td>
<td>1.38</td>
</tr>
<tr>
<td>2010</td>
<td>26</td>
<td>1.18</td>
</tr>
<tr>
<td>2011</td>
<td>24</td>
<td>1.20</td>
</tr>
<tr>
<td>2012</td>
<td>32</td>
<td>1.78</td>
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</tbody>
</table>

Table 5. Invited seminars at peer institutes (total and FTE) in the past five years

<table>
<thead>
<tr>
<th></th>
<th># Invited Seminars</th>
<th># Seminars / FTE</th>
</tr>
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<tbody>
<tr>
<td>2008</td>
<td>17</td>
<td>0.77</td>
</tr>
<tr>
<td>2009</td>
<td>22</td>
<td>1.05</td>
</tr>
<tr>
<td>2010</td>
<td>16</td>
<td>0.73</td>
</tr>
<tr>
<td>2011</td>
<td>15</td>
<td>0.75</td>
</tr>
<tr>
<td>2012</td>
<td>13</td>
<td>0.72</td>
</tr>
</tbody>
</table>
In addition, ISEN faculty are regularly asked to serve as reviewers for proposals and awards. A partial list of recent activity is given below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satish Bukkapatnam</td>
<td>Proposal review panelist, National Science Foundation, 2004-present</td>
</tr>
<tr>
<td>Sergiy Butenko</td>
<td>Proposal review panelist, National Science Foundation (8 times)</td>
</tr>
<tr>
<td></td>
<td>CAREER proposal review panelist, U.S. Department of Energy</td>
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<tr>
<td></td>
<td>Ad-hoc proposal reviewer, Air Force Office of Scientific Research</td>
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<tr>
<td></td>
<td>Ad-hoc proposal reviewer, Civilian Research and Development Foundation</td>
</tr>
<tr>
<td>Sıla Çetinkaya</td>
<td>Panelist (dates confidential), National Science Foundation.</td>
</tr>
<tr>
<td></td>
<td>Proposal Reviewer (dates confidential):</td>
</tr>
<tr>
<td></td>
<td>• Dutch Research Council,</td>
</tr>
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<td></td>
<td>• Israel Research Foundation,</td>
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<tr>
<td></td>
<td>• Hong Kong Research Grants Council,</td>
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<td></td>
<td>• Louisiana Board of Regents,</td>
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<td></td>
<td>• The Netherlands Organization for Scientific Research.</td>
</tr>
<tr>
<td>Yu Ding</td>
<td>French and American Partner University Fund proposal review, 2013</td>
</tr>
<tr>
<td></td>
<td>NSF Review Panel, 2012</td>
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<tr>
<td></td>
<td>Singapore Ministry of Education Academic Research Fund proposal review, 2010</td>
</tr>
<tr>
<td></td>
<td>Swedish Knowledge Foundation proposal review, 2008</td>
</tr>
<tr>
<td>Tom Ferris</td>
<td>Proposal Reviewer for NSF, 2012</td>
</tr>
<tr>
<td>Natarajan Gautam</td>
<td>Proposal Reviewer for Austrian Science Fund, 2010</td>
</tr>
<tr>
<td></td>
<td>Proposal Reviewer, Center for Multimodal Solutions for Congestion Mitigation, Florida 2008, 2010</td>
</tr>
<tr>
<td>Andrew Johnson</td>
<td>Ad-hoc review panel for NSF Service Enterprise Systems, 2007</td>
</tr>
<tr>
<td>Kiavash Kianfar</td>
<td>Proposal Review Panelist, National Science Foundation.</td>
</tr>
<tr>
<td>Erick Moreno- Centeno</td>
<td>Proposal Reviewer, National Science Foundation, 2013</td>
</tr>
<tr>
<td></td>
<td>Panel Organizer, INFORMS Annual Meeting, 2013</td>
</tr>
</tbody>
</table>
The next two tables (Table 7 and Table 8) show editorial positions and major professional activities undertaken by the ISEN faculty.

**Table 7. Editorships or editorial positions assumed by the ISEN Faculty**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department/Editorial Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satish Bukkapatnam</td>
<td>Department Editor for IIE Transactions focused issue on Quality and Reliability Engineering (QRE) 2008-present</td>
</tr>
<tr>
<td></td>
<td>Department Editor for IIE Transactions focused issue on Manufacturing and Design (MD), 2008-present</td>
</tr>
<tr>
<td></td>
<td>Guest Editor, IIE Transactions Joint Special Issue on Quality and Design Issues in Nanomanufacturing, 2012</td>
</tr>
<tr>
<td></td>
<td>Area Editor, Computers in IE, 2007-present</td>
</tr>
<tr>
<td></td>
<td>Associate Editor, International Journal of Quality, Statistics and Reliability, 2007-present</td>
</tr>
<tr>
<td></td>
<td>Editorial Board Member, Journal of Combinatorial Optimization (since 2007)</td>
</tr>
<tr>
<td></td>
<td>Editorial Board Member, Optimization Letters (since 2006)</td>
</tr>
<tr>
<td></td>
<td>Editorial Board Member, Computational Management Science (since 2005)</td>
</tr>
<tr>
<td>Sila Çetinkaya</td>
<td>Department Editor, Supply Chains, IIE Transactions on Scheduling and Logistics, since 2006.</td>
</tr>
<tr>
<td></td>
<td>Associate Editor, Naval Research Logistics, since 2006.</td>
</tr>
<tr>
<td></td>
<td>Editorial Board Member, International Journal of Inventory Research, since June 2005.</td>
</tr>
</tbody>
</table>
Yu Ding Department editor, IIE Transactions on Quality and

Tom Ferris Guest editor, Special issue Health Environments Research
and Design (HERD), 2013

Natarajan Gautam Associate Editor, INFORMS Journal on Computing, 2001 –
present.
Associate Editor, Omega, 2010 – present.
Area Editor, IIE Transactions on Operations Engineering, 2011 – present

Andrew Johnson Associate Editor – The Data Envelopment Analysis Journal
(2011 – present)
Associate Editor – International Transactions in Operational
Research (2012 – present)

Kiavash Kianfar Associate Editor: Scientia Iranica Transactions on Industrial
Engineering, 2008 - Present

Georgia-Ann Klutke Consulting Editor, Springer Series in Mechanical
Engineering, 1995 - present

Lewis Ntaimo Journal of Global Optimization

Halit Üster Associate Editor, IIE Transactions, 2005 – 2010

Table 8. Major national and international professional activities of ISEN faculty

Sergiy Butenko Member of the program committee, INFORMS Optimization
Society Conference, Houston, Texas, March 6-8, 2014
Co-organizer of NATO Advanced Research Workshop:
Examining Robustness and Vulnerability of Critical
Infrastructure Networks, Kyiv, Ukraine, June 3-5, 2013
Member of the program committee, 4-th Annual International
Conference on Combinatorial Optimization and Applications
(COCOA’10), The Big Island, Hawaii, December 18-20, 2010
Co-organizer of Yalta Optimization Conference: Network
Science, Yalta, Ukraine, August 2-4, 2010
Co-organizer of Yalta Optimization Conference: Network
Science, Yalta, Ukraine, August 2-4, 2010
Member of the program committee, 3-rd Annual International
Conference on Combinatorial Optimization and Applications
(COCOA’09), Yellow Mountains, China, June 10-12, 2009
Co-organizer of Yalta Conference on Discrete and Global Optimization, Yalta, Ukraine, July 31 – August 2, 2008
Co-organizer of International Conference on Applied Optimization and Metaheuristic Innovations, Yalta, Ukraine, July 19-21, 2006
Co-organizer of DIMACS Workshop on Clustering Problems in Biological Networks, Rutgers University, Piscataway, NJ, May 9-11, 2006

Sıla Çetinkaya

Program Chair - ISERC 2015, IIE Annual Conference and Expo, Location: TBD.
Co-chair, Doing Good with Good OR Student Paper Competition, INFORMS, 2012.
Co-chair, Interactive Sessions, INFORMS, Austin, Texas, 2010.
Cluster Chair, MSOM Supply Chain, INFORMS, Austin, Texas, 2010.
Review Committee Member, Manufacturing and Service Operations Management Conference (2006, 2008, 2009)
Review Committee Member, APMS International Conference Sustainable Production and Service Supply Chains, 2013.
Awards Committee Member, Doing Good with Good OR Student Paper Competition, INFORMS, 2011, 2013.
Review Committee Member, Student Paper Competition, POMS College of Supply Chain Management, 2009.

Yu Ding

Chair, INFORMS Section on Quality, Statistics, and Reliability, 2008.

Tom Ferris

Human Factors and Ergonomics Track chair for ISERC 2014 in Montreal

Natarajan Gautam

Visiting Imperial College, Department of Computing, Fall 2013.
Invited Participant – Workshop on the Frontiers of Controls, Games and Network Science, Univ. of Texas at Austin, February 2010.
Invited Participant – Winedale Workshop on Networks and Learning, Texas A&M, Univ. of Texas at Austin and Rice University, October 2009.
Past-President, IIE’s CIS division Board, 2010-2011.
President, IIE’s CIS division Board, 2009-2010.
President-Elect, IIE’s CIS division Board, 2008-2009.
Director, IIE’s CIS division Board, 2006-2008.
Treasurer, Omega Rho, 2010-2012.
Member-of-council for INFORMS Telecommunication Section, 2006-2010.

Andrew Johnson

2013 INFORMS Colloquia Committee
2013 Organizing Committee, “European Workshop on Efficiency and Productivity Analysis XIII 2013 (EWEPA XIII)”, Aalto University, Helsinki, Finland.
2013 Track Chair, Data Envelopment Analysis, INFORMS, Minneapolis, MN, 2013
2013 Co-Track Chair, Facility Logistics, ISERC Conference, Puerto Rico, 2013
2012 Track Chair, Data Envelopment Analysis, INFORMS, Phoenix, AZ, 2012
2012 Co-Track Chair, Facility Logistics, ISERC Conference, Orlando, FL, 2012
2009 Track Organizer, Facility Logistics, INFORMS, San
Diego, CA, 2009
2009 Co-Track Organizer, Round-table: Interfaces with Engineering Applications, European Workshop on Efficiency Productivity Analysis XI 2009 (EWEPA XI)

Kiavash Kianfar
Session Chair: INFORMS Annual Meeting, Minneapolis, MN, Oct. 2013
Session Chair: INFORMS Annual Meeting, Charlotte, NC, Nov. 2011
Session Chair: INFORMS Annual Meeting, Austin, TX, Nov. 2010
Session Chair: INFORMS Southwest Regional Conference, College Station, TX, Apr. 2008

Erick Moreno-Centeno
Session Chair, INFORMS Annual Meeting, 2013
Scientific Committee Member, joint 5th Latin-Ibero-American OR Workshop (TLAIO-V) and (CSMIO-II), 2013
Session Chair, Mexican OR Society Conference (CSMIO-I), 2012
Judge, INFORMS Decision Analysis Society Student Paper Competition, 2012
Scientific Committee Member, 1st Mexican OR Society Annual Conference (CSMIO-I), 2012
Session Chair, INFORMS Annual Meeting, 2008

Lewis Ntaimo
Vice Chair: INFORMS Optimization Society, 2010-2012
Secretary: INFORMS Minority Issues Forum, 2013-present
Session Chair: INFORMS, 2008-2013
Session Chair: IIE Conference, 2012
Session Chair: IFORS, 2011
Technical Committee: DEVS Symposium, Spring Simulation Multiconference, 2006 – present

Halit Üster
Chair, INFORMS New Faculty Colloquium, to be inaugurated at INFORMS Conference, 2014.
Organizer, ISEN Seminar Series in conjunction with ADVANCE Center, Fall 2012 and 2013.
Organizer, Panel on “How to Undertake Collaborative
Member, INFORMS Subdivisions Council, 2007 - 2009.
Chair, INFORMS Southwest Regional Conference, Texas A&M Univ, College Station, TX, April, 2008.
Chair, UPS-SOLA Bi-Annual Dissertation Award Committee (SOLA: Section on Location Analysis), 2007.
Cluster Co-Chair, sponsored by Telecommunications Section, INFORMS Conference, 2007 and 2008.
Member, Organizing Committee of the New Faculty Colloquium at IERC, Orlando, FL, 2006.

Invited Seminars
Seventh Annual Workshop on Supply Chain and Logistics, Bilkent University, Ankara, Turkey. June 2013.
Middle East Technical University (METU), Industrial Engineering, Ankara, Turkey, May 2013.
Bilkent University, Industrial Engineering, Ankara, Turkey, May 2013.
Bogazici University, Industrial Engineering, Istanbul, Turkey, April 2013.
University of Houston, Industrial Engineering, November 2012.
Sabanci University, Manufacturing Systems/Industrial Engineering, Istanbul, Turkey, August 2012.
Koc University, Industrial Engineering, Istanbul, Turkey, July 2012.
Erasmus University, Rotterdam School of Management, The Netherlands, August 2011.
Texas A&M University, ISEN, Parsons Seminar Series, September 2010.
University of Michigan, Industrial and Operations Engineering, March 2010.
Northwestern University, Transportation Center, February 2010.
Northwestern University, Industrial Engineering and Management Sciences, October 2009.
Monterrey Tech, Industrial Engineering, Toluca, Mexico, November 2006.
A4. Faculty Research Areas

Current faculty research activities cover a broad spectrum of applications and industry sectors. Although there are no formal sub-areas of specialization within the department, faculty expertise can be classified into the following research areas:

- Applied Probability and Risk;
- Human and Organizational Systems;
- Manufacturing Systems and Control;
- Optimization;
- Supply Chain Systems;
- System Informatics.

Table 9 below shows faculty listed by their research specialties. In this table an “X” indicates the primary area and “2” indicates a secondary area. The bottom part of the table shows the connection of faculty research interests and activities to the college’s strategic areas.
Table 9. Faculty research area

<table>
<thead>
<tr>
<th>Research areas</th>
<th>Arvanit</th>
<th>Bardejove</th>
<th>Bukvapschom</th>
<th>Butenko</th>
<th>Celikaya</th>
<th>Curry</th>
<th>Ding</th>
<th>Elwany</th>
<th>Ferlies</th>
<th>Gavrul</th>
<th>Johnson</th>
<th>Klantar</th>
<th>Kidde</th>
<th>Malave</th>
<th>Moreno-Centeno</th>
<th>Miao</th>
<th>Smith</th>
<th>Uster</th>
<th>Worman</th>
<th>Yates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Probability &amp; Risk</td>
<td></td>
<td></td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Human and Organizational Systems</td>
<td>X</td>
<td>2</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Manufacturing Systems and Control</td>
<td>2</td>
<td>X</td>
<td>2</td>
<td>2</td>
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<td>Optimization</td>
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<td>Supply Chain Systems</td>
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<tr>
<td>System Informatics</td>
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<td>Energy</td>
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<td>Healthcare</td>
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<tr>
<td>Homeland security</td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>Informatics</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>Infrastructure &amp; Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Systems Engineering</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
A5. Research Grants and Expenditures

Figure 7 shows new awards for each of the last five years. The majority of these funds have come from federal sources, with smaller amounts coming from industry and the state of Texas.

Figure 7. Annual awards by year

Figure 8 below shows the annual research expenditures over the last five years. AFOSR, NSF, Department of Homeland Security, and Department of Human and Health Service are the largest contributors.

Figure 8. Research expenditures
A6. Teaching Load

The standard teaching load of the core faculty is three courses per year. New hires usually receive one course reduction per year for the first two years. The department head is on a 12-month administrative appointment and has no teaching obligation. Three other positions, associate department head, director of graduate programs, and director of undergraduate program, also receive a one course reduction per year.

B. Faculty Other Than Core (as defined above)

B1. Number

The ISEN category other than core faculty includes: 2 tenured professors on administrative posts, one at TAMU and one at TAMU – Qatar campus; 2 professors of practice; 4 senior professors; 3 lecturers; 4 adjunct professors; 1 TEES research professor; 7 emeritus professors; and 2 tenured professors jointly appointed with ISEN but ad-loc to other engineering departments. The total head count of this category is 25, and of that, 11 are engaged in the department’s teaching mission.

B2. Faculty/Student Ratio

The following ratios are the number of students in each category per teaching-engaged faculty.

<table>
<thead>
<tr>
<th></th>
<th>PHD to faculty (teaching)</th>
<th>Master to faculty (teaching)</th>
<th>U/G to faculty (teaching)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.3</td>
<td>16</td>
<td>61</td>
</tr>
</tbody>
</table>

B3. Teaching Load

Teaching loads for faculty other than core varies considerably. A full load is six courses per year. The eleven teaching-engaged faculty members have various percentages of appointment from 33% to 100%. The average is 50%.

C. Faculty Diversity

The following table shows the diversity of the core faculty by ethnicity (White, Black, Hispanic, Other) and gender.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
The following table shows the diversity of the teaching-engaged faculty (other than core) by ethnicity (White, Black, Hispanic, Other) and gender.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

D. Faculty Qualifications and Recognition

While they represent diverse backgrounds and areas of expertise, the Department of Industrial and Systems Engineering faculty share a common interest in industrial and systems engineering research and education. Members of the faculty are nationally recognized for contributions in a variety of areas of research and for service to the industrial engineering profession. Faculty have received many awards both from the university and outside the university. Several faculty members are Fellows of the Institute of Industrial Engineers, the Human Factors and Ergonomics Society, and the Society for Logistics Engineers. Departmental faculty members hold a number of significant editorial positions and serve on national review panels and advisory boards; for details, see Section A3 of this chapter.

Two Industrial and Systems Engineering faculty members hold endowed professorships: Cesar O. Malavé holds the Sugar and Mike Barnes Department Head Chair, and Satish Bukkapatnam is the Rockwell International Professor. Two jointly appointed faculty members also hold endowed professorships: Jorge Leon is the Allen-Bradley Professor in Factory Automation and M. Sam Mannan holds the T. Michael O’Connor Chair. Two Industrial and Systems Engineering faculty members hold endowed faculty fellowships: Natarajan Gautam is the Jill and Charles F. Milstead’60 Faculty Fellow and Sergiy Butenko is the Donna and Jim Furber ’64 Faculty Fellow. One faculty member (Ralph L. Disney^{e}) is a member of the National Academy of Engineering (Note: a superscript ^{e} denotes an emeritus faculty member, a superscript ^{s} denotes a senior professor who gave up tenure but still serves the department in various capacities.).

A number of current faculty members have been recognized as Fellows of professional societies. These include:

Institute of Industrial Engineers

Ralph L. Disney^{e}, 1981
G. Kemble Bennett^{s}, 1989
Milden J. Fox^{e}, 1991
Don T. Phillips^{s}, 1991
Newton C. Ellis^{e}, 1992
Wilbert E. Wilhelm^{e}, 1992
Alberto Garcia-Diaz, 1999
Hamid R. Parsaei, 1997
Georgia-Ann Klutke, 2005
Guy Curry, 2010
Sila Çetinkaya, 2012

Human Factors and Ergonomics Society

Newton C. Ellis
Rodger J. Koppa

Society of Logistics Engineers

G. Kemble Bennett, 1988

National Academy of Engineering

Ralph L. Disney, 1997

The ISEN faculty has been recognized with many national awards as well as university/college awards. The following is a list of notable awards received by the ISEN faculty.

National Awards

G. Kemble Bennett Albert G. Holtzman Distinguished Educator Award, IIE, 1996

Amarnath Banerjee NASA Tech Brief Award for the project Virtual Video for Remote Cockpit Design, 2009
Binary Time Series Prediction Contest Winner, ANNIE, 2006

Sergiy Butenko Air Force Office of Scientific Research, Young Investigator Award, 2008

Guy Curry Outstanding Publication Award, IIE, 1998
Eastern Oklahoma State College – Hall of Fame – November 2000
Albert G. Holzman Distinguished Educator Award, 2006

Bryan Deuermeyer Outstanding Publication Award, IIE, 1998

Ralph L. Disney Dr. David F. Baker Distinguished Research Award, IIE, 1972
Albert G. Holzman Distinguished Educator Award, IIE, 1986
Frank and Lilian Gilbreth IE Award, IIE, 1993

Sila Çetinkaya CAREER Award, National Science Foundation, 2001
Outstanding Young Industrial Engineer – Education, IIE, 2003
Operations Research Meritorious Service Award, INFORMS, 2003
Best Paper Award, IIE Transactions on Scheduling and Logistics, 2010
Moving Spirit Award, INFORMS, 2011

Yu Ding
CAREER Award, National Science Foundation, 2004
Best Paper Award, IIE Transactions on Quality and Reliability, 2006

Newton Ellis
Dr. David F. Baker Distinguished Research Award, IIE, 1995

Natarajan Gautam
Outstanding Young Industrial Engineer – Education, IIE, 2006

Kiavash Kianfar
IIE Pritsker Doctoral Dissertation Award, 1st Place, 2008
Finalist, INFORMS George Nicholson Award, 2006.

Don T. Phillips
IIE/Joint Publishers Book-of-the-Year Award, IIE, 1977
Dr. David F. Baker Distinguished Research Award, IIE, 1989

Halit Üster
Moving Spirit Award, INFORMS, 2007
Eshbach Society Distinguished Visiting Scholar in the McCormick School of Engineering & Applied Science, Northwestern University, 2009

Wilbert Wilhelm
Dr. David D. Baker Distinguished Research Award, IIE, 1996
Society of Manufacturing Engineers Gold Medal, 2011

University/College Awards (since 2008)

Andy Banerjee
2013 Charles Crawford Award for Service, College of Engineering
2012 William O. and Montine P. Head Faculty Fellow, College of Engineering
2009 William O. and Montine P. Head Faculty Fellow, College of Engineering
2009 Charles W. Crawford Service Award, College of Engineering

Kemble Bennett
2011 Association of Former Students Distinguished Faculty Achievement Award for Administration (University Level)

Sergiy Butenko
2012 Charles H. Barclay, Jr.’45 Faculty Fellow, College of Engineering

Sila Çetinkaya
2011 William O. and Montine P. Head Faculty Fellow, College of Engineering
Engineering

Guy Curry  2010 Association of Former Students Distinguished Faculty Achievement Award for Teaching (University Level)
           2011 Charles Crawford Distinguished Service Award

Yu Ding    2013 Charles H. Barclay, Jr.’45 Faculty Fellow, College of Engineering
           2011 TEES Fellow Award, College of Engineering
           2009 Brockett Professorship Award, College of Engineering

Richard Feldman  2010 Tenneco Award for Teaching, College of Engineering

Natarajan Gautam  2012 Tenneco Meritorious Teaching Award, College of Engineering

Georgia-Ann Klutke 2008, Halliburton Faculty Fellow, College of Engineering

Erick Moreno-Centeno  2012 Montague Center for Teaching Excellence Award, Texas A&M University

Lewis Ntaiomo 2010, George Armistead, Jr. ‘23 Faculty Fellow, College of Engineering

Don Smith  2013 Association of Former Students Distinguished Achievement Award – Teaching (College Level)

Halit Üster 2011 Caterpillar Teaching Excellence Award, College of Engineering

Jim Wall 2009 Regents Fellow Service Award, Texas A&M Systems.

E.  Analysis

As stated in the previous section, the Department of Industrial and Systems Engineering faculty is nationally recognized for contributions in a variety of areas of research and for service to the industrial engineering profession. This report presents a full array of data supporting the claim. Here we present a summary analysis of faculty teaching, research, and service.

The ISEN faculty shoulders a large portion of the college’s teaching duties. The department currently has 674 undergraduate students and 223 graduate students. The ratio of students to core faculty was 48 in 2012 when the faculty size was 18, the second highest only behind Petroleum Engineering Department in the College (Figure 9). Not only does the ISEN faculty teach a large number of students but also their teaching is highly praised by the students. The average teaching evaluation of all courses is 4.16 (out of 5.0). Many faculty members won numerous teaching awards, including highly competitive and prestigious ones at the university level.
The ISEN faculty has been active in pursuing cutting edge research. Admittedly, the research expenditure of this department from external sources is low compared to other engineering departments and overall ISEN research expenditure has remained noticeably below the college's average in the past decade (see Figure 10).

But the faculty has made a significant effort in the past decade, doubling the research expenditure (external sources) per faculty per year from $36K in 2005 to $78K in 2012. As shown in Table 9, the ISEN faculty is engaging in virtually all strategic research areas identified by the college. With newly hired faculty capable of building critical mass in areas such as next-generation manufacturing and with additional resources promised to enhance the ISEN faculty’s portfolio, we believe that the trend of increasing faculty research expenditure will continue, and that the ISEN expenditure can catch up with the college average in the near future.

The ISEN faculty has done great service for the department, the college, the university, and the professional societies they are affiliated with. ISEN faculty members participate in the departmental and college committees with great enthusiasm and diligence. The committees worked effectively, producing recommendations to reform and improve our academic programs or organizing activities to enhance the undergraduate experience and improve the graduate program’s climate. Many faculty members are actively engaged in national and international service by holding editorial positions, serving on national review panels and advisory boards. One important area where the department needs improvement is in motivating and promoting faculty members to seek and hold...
key leadership positions at the national or international level (such as IIE president or INFORMS president).

![Research expenditure from external sources per faculty per year (in thousands of dollars): ISEN versus the college average.](image-url)

Figure 10 Research expenditure from external sources per faculty per year (in thousands of dollars): ISEN versus the college average.
V. Student Profile

A. Doctoral Students

A1. Enrollment, including % of Full-time Students

The university defines full-time doctoral students as those who register to take 9 hours or above per semester. Part-time Ph.D. students are usually one of two types: those in absentia (we had three students in absentia in 2012) and students who are going to take the dissertation defense soon, and therefore register for only one credit hour that semester (called the reduced course load).

<table>
<thead>
<tr>
<th>Cohort Term</th>
<th>Full-time</th>
<th>Part-time</th>
<th>All PHD</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>58</td>
<td>7</td>
<td>65</td>
<td>89%</td>
</tr>
<tr>
<td>2009</td>
<td>72</td>
<td>6</td>
<td>78</td>
<td>92%</td>
</tr>
<tr>
<td>2010</td>
<td>61</td>
<td>7</td>
<td>68</td>
<td>90%</td>
</tr>
<tr>
<td>2011</td>
<td>54</td>
<td>9</td>
<td>63</td>
<td>86%</td>
</tr>
<tr>
<td>2012</td>
<td>50</td>
<td>6</td>
<td>56</td>
<td>89%</td>
</tr>
</tbody>
</table>

A2. Student Diversity/Demographics

The three subsequent charts show the doctoral student demographics and gender statistics by enrollments. In these charts, domestic students include both U.S. citizens and permanent residents.
The next three charts show the doctoral student demographics and gender statistics by the number of degrees awarded.
A3. Retention Rates

The following chart shows the number of students remaining in the doctoral program over the years. This is a multiple-year average, based on the starting cohorts of 2003 to 2010.

A4. Graduation Rates

The average of the percent of first-year doctoral students who graduated with a Ph.D.
degree is \( 65.7\% \). Another 30.6\% of the students started in the doctoral program but exited with a master’s degree due to various reasons, but the most common reason is failing the qualifying or preliminary exam. Altogether, 96.3\% of the students entering the Ph.D. program graduated with a graduate degree.

![Bar chart showing graduation rates and exit without degree](chart)

A5. Average Time to Degree

Cross reference Chapter III, Section F2.

A6. Average Institutional Financial Support Provided

For available financial support instruments for doctoral students, please see Chapter III, Section G. For teaching assistantships, the department pays a doctoral student a monthly stipend of $1,700, plus tuition, fringe benefit and student insurance coverage. The total financial package for a 9-month period is about $21,000, and that for a 12-month period is about $28,000.

For research assistantships, the pay is comparable with that of teaching assistantship. Faculty members can pay their students a higher stipend.

The Merit Fellowship offered by the OGS, if awarded to a student, pays the student a $25,000 stipend in the first year, translating into $2,083 per month for the fellowship awardee. The Diversity Fellowship pays recipients at the level of a department’s

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\(^1\) This graduation rate is from DARS (TAMU’s Data and Research Services). The graduation rate of 72\% reported in our 2012’s 18 Characteristics of Texas Public Doctoral Programs (included in the appendix) is based on the departmental data. The 6\% difference translates to about two students. We counted the two students in the Interdisciplinary Engineering Ph.D. (ITDE) program as ours, because their advisors were ISEN faculty members and their major research activities were done at the ISEN department.
standard pay.

The ISEN department established two Departmental Graduate Fellowships in the fall semester of 2013. The Departmental Graduate Fellowships work similarly as the Merit Fellowship, and pays the award recipients $2,000 a month, or equivalently, $24,000 a year.

The department has a limited number of $1,000 per year scholarships given to qualified students. These scholarships also include a waiver of out-of-state tuition for the academic year, so recipients pay only in-state tuition and fees. The scholarships are given for one academic year only and are extended based on the same competitive basis as the original award.

A7. Percent of Full-time Students with Institutional Financial Support

Doctoral students in the department have been supported by various means. In the 2013 Fall Semester, the number of students under each category of support is listed below:

<table>
<thead>
<tr>
<th>Type of Assistance</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Assistantship</td>
<td>20.5</td>
<td>44%</td>
</tr>
<tr>
<td>Research Assistantship</td>
<td>18</td>
<td>38%</td>
</tr>
<tr>
<td>Fellowship</td>
<td>4.5</td>
<td>10%</td>
</tr>
<tr>
<td>$1K Scholarship</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Unfunded</td>
<td>3</td>
<td>6%</td>
</tr>
</tbody>
</table>

In the table above, one student is supported by the Diversity Fellowship, which requires 50% matching funds from the department in the form of a TA position; half of the support is credited to the fellowship and half to the teaching assistantship. Among the three unfunded students, two are in-absentia. So only one student among the full-time students does not have institutional financial support, or equivalently, 98% of full-time doctoral students have institutional financial support.

A8. Student Publications/Presentations (most recent 5 years)

The next two tables show students’ scholarly activities. Because we do not keep this student-related data, we had to ask current Ph.D. students in October 2013 to report their publications and presentations activities in the past five years. This explains the much smaller numbers for 2009 and 2010, which, in terms of publications, are zeros. The current Ph.D. students were still in their early years in 2009 and 2010, and thus were not expected to publish anything.
<table>
<thead>
<tr>
<th></th>
<th># Conference presentations</th>
<th># of students who made a presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2010</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>2011</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>2012</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>2013</td>
<td>21</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th># Journal publications</th>
<th># of students who published a paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

The table below includes journal papers both published and accepted.

The next table is a partial list of students receiving awards and recognition in the past year.

<table>
<thead>
<tr>
<th>Date</th>
<th>Student Name(s)</th>
<th>Nature of Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/26/2013</td>
<td>Arupa Mohapatra</td>
<td>U.S. Senator Phil Gramm Doctoral Fellowship</td>
</tr>
<tr>
<td>4/11/2013</td>
<td>Austin L. Buchanan</td>
<td>Gilbreth Memorial Fellowship from IIE</td>
</tr>
<tr>
<td>4/26/2013</td>
<td>Shilan Jin, Yanjun Qian, and Su Zhao</td>
<td>2013 Dow Chemical &quot;Big Data Challenge&quot; First Prize</td>
</tr>
<tr>
<td>5/1/2013</td>
<td>Samyukta Sethuraman</td>
<td>Runner-up in the Best Student Paper competition at 2013 Computational Management Science Conference</td>
</tr>
<tr>
<td>5/20/2013</td>
<td>Austin Buchanan</td>
<td>Tompkins International Honor Scholarship from the Material Handling Education Foundation</td>
</tr>
<tr>
<td>5/29/2013</td>
<td>Austin Buchanan</td>
<td>Jimmy H. Smith Graduate Scholarship from the Texas Engineering Foundation</td>
</tr>
<tr>
<td>7/25/2013</td>
<td>Manish Bansal</td>
<td>First prize in poster competition in MIP Workshop 2013, Madison, WI</td>
</tr>
<tr>
<td>8/27/2013</td>
<td>Su Zhao</td>
<td>$1000 Graduate Scholarship</td>
</tr>
</tbody>
</table>
A9. Employment Profile (in field within one year of graduation)

<table>
<thead>
<tr>
<th>Year</th>
<th>Student</th>
<th>Advisor</th>
<th>Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Abdullah Cerekci</td>
<td>Banerjee</td>
<td>Zorlu Holding, Turkey</td>
</tr>
<tr>
<td>2008</td>
<td>Gopalakrishnan Easwaran</td>
<td>Cetinkaya &amp; Uster</td>
<td>Associate Professor, St. Mary's University, San Antonio, Texas</td>
</tr>
<tr>
<td>2008</td>
<td>Cesar Rincon Mateus</td>
<td>Gautam</td>
<td>Delta Airlines</td>
</tr>
<tr>
<td>2008</td>
<td>Patricia May</td>
<td>Malave</td>
<td>Medical Device Product Development Firm, Sacramento, CA</td>
</tr>
<tr>
<td>2008</td>
<td>Yuan Ren</td>
<td>Ding</td>
<td>Yahoo!</td>
</tr>
<tr>
<td>2008</td>
<td>Bikram Sharda</td>
<td>Banerjee</td>
<td>Dow Chemical Company</td>
</tr>
<tr>
<td>2008</td>
<td>Haifeng Xia</td>
<td>Ding</td>
<td>Public Education Department, State of New Mexico</td>
</tr>
<tr>
<td>2009</td>
<td>Piyush Goel</td>
<td>Gautam</td>
<td>Capital One</td>
</tr>
<tr>
<td>2009</td>
<td>Mayra Mendez</td>
<td>Malave</td>
<td>Assistant Professor, University of Puerto Rico – Mayaguez</td>
</tr>
<tr>
<td>2009</td>
<td>Roberto Seijo</td>
<td>Malave</td>
<td>Assistant Professor, University of Puerto Rico – Mayaguez</td>
</tr>
<tr>
<td>2009</td>
<td>Abhishek K. Shrivastava</td>
<td>Ding</td>
<td>Assistant Professor, Florida State University</td>
</tr>
<tr>
<td>2009</td>
<td>Matthew W. Tanner</td>
<td>Ntaimo</td>
<td>Navigant Consulting</td>
</tr>
<tr>
<td>2009</td>
<td>Joaquin E. Torres-Soto</td>
<td>Uster</td>
<td>Assistant Professor, ITESM Campus Chihuahua, Mexico</td>
</tr>
<tr>
<td>2010</td>
<td>Eunshin Byon</td>
<td>Ding</td>
<td>Assistant Professor, University of Michigan</td>
</tr>
<tr>
<td>2010</td>
<td>Panitan (Ken) Kewcharoenwong</td>
<td>Uster</td>
<td>Postdoctoral fellow, Northwestern University</td>
</tr>
<tr>
<td>Year</td>
<td>First Name</td>
<td>Last Name</td>
<td>Affiliation</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>2010</td>
<td>Hyunsoo</td>
<td>Lee</td>
<td>Assistant Professor, Kumoh National Institute of Technology, Korea</td>
</tr>
<tr>
<td>2010</td>
<td>Eduardo Pérez</td>
<td>Ntaimo</td>
<td>Assistant Professor, Texas State University</td>
</tr>
<tr>
<td>2011</td>
<td>Eric Beier</td>
<td>Ntaimo</td>
<td>General Dynamics Information Technology</td>
</tr>
<tr>
<td>2011</td>
<td>Hui Lin</td>
<td>Uster</td>
<td>Bank of America, Dallas, TX</td>
</tr>
<tr>
<td>2011</td>
<td>Young Myoung Ko</td>
<td>Gautam</td>
<td>Assistant Professor, POSTECH, Korea</td>
</tr>
<tr>
<td>2011</td>
<td>Chiwoo Park</td>
<td>Ding</td>
<td>Assistant Professor, Florida State University</td>
</tr>
<tr>
<td>2011</td>
<td>Hongsuk Park</td>
<td>Banerjee</td>
<td>Korean Army Officer</td>
</tr>
<tr>
<td>2011</td>
<td>Brandon Pope</td>
<td>Johnson &amp; Deshmukh</td>
<td>Regenstrief Fellow, Regenstrief Center for Healthcare Engineering at Purdue University</td>
</tr>
<tr>
<td>2011</td>
<td>Liqing Zhang</td>
<td>Cetinkaya</td>
<td>United Airlines</td>
</tr>
<tr>
<td>2012</td>
<td>Ezgi Can Eren</td>
<td>Gautam</td>
<td>PROS</td>
</tr>
<tr>
<td>2012</td>
<td>Sangdo Choi</td>
<td>Wilhelm</td>
<td>Visiting Assistant Professor at University of Florida</td>
</tr>
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<td>Chia-Yen Lee</td>
<td>Johnson</td>
<td>Assistant Professor, National Cheng Kung University, Taiwan</td>
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<td>2012</td>
<td>Maethee Mekaroonreung</td>
<td>Johnson</td>
<td>Standard Chartered Bank, Thailand</td>
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<td>Hiram Moya</td>
<td>Curry</td>
<td>Assistant Professor, University of Texas-Pan American</td>
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<tr>
<td>2012</td>
<td>Sujeevraja Sanjeevi</td>
<td>Kianfar</td>
<td>Sabre Holdings</td>
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<tr>
<td>2012</td>
<td>Xinghua Wang</td>
<td>Uster &amp; Yates</td>
<td>Fedex, Memphis, TX</td>
</tr>
<tr>
<td>2013</td>
<td>Julian A. Gallego Arrubla</td>
<td>Ntaimo</td>
<td>Post-doc at TAMU</td>
</tr>
<tr>
<td>2013</td>
<td>Tanisha G. Cotton</td>
<td>Ntaimo</td>
<td>Job market</td>
</tr>
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<td>Abhilasha Prakash Katariya</td>
<td>Cetinkaya &amp; Tekin</td>
<td>Job market</td>
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<td>2013</td>
<td>Giwhyun Lee</td>
<td>Ding</td>
<td>Assistant Professor, Korea Army Academy at Yeongcheon</td>
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<tr>
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<td>Suhwan Kim</td>
<td>Wilhelm</td>
<td>Assistant Professor at Korea National Defense University</td>
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<td>Samuel Merriweather</td>
<td>Tekin &amp; Wortman</td>
<td>Unknown</td>
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<td>2013</td>
<td>Arupa Mohapatra</td>
<td>Gautam</td>
<td>Oracle</td>
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<tr>
<td>2013</td>
<td>Shahram Shahinpour</td>
<td>Butenko</td>
<td>Sabre Consulting</td>
</tr>
</tbody>
</table>

B. All Other Students

B1. Undergraduate Demographics

The following two charts show our undergraduate students demographics by enrollments and degrees awarded, respectively.
The next two charts show our undergraduate students’ gender statistics, by enrollment and by degrees awarded, respectively.

![Undergraduate Enrollment by Gender](chart1)

B2. Master’s Students Demographics

The following two charts show our master’s students demographics by enrollments.
The following two charts show our master’s students demographics by degrees awarded.
The next two charts show our master’s students gender statistics by enrollments and by degrees awarded, respectively.

B3. Retention Rates

For our undergraduate student retention analysis, go to Chapter II, Section K.

The following chart shows the master’s students retention. Each bar indicates the percentage of students remaining in the program at the end of each academic year. The majority of our master’s students graduate in 24 months and almost all graduate within 36 months (average is about 30 months). The tail distribution catches primarily
students in the distance learning program.

B4. Graduation Rates

For undergraduate students, their graduation rate is about 53%. For a more detailed analysis, please reference to Chapter II, Section K.

The following chart shows the master’s student graduation rate. Altogether, 86% of the master’s students either graduated with a master’s degree or continued in a Ph.D. program. About 14% of the master’s students left our programs without a degree.

C. Outstanding Alumni

W. Michael Barnes  
*BS ‘63, MS ‘66, Ph.D. Operations Research ‘68*  
Senior VP and CFO,  
Rockwell International Corporation

Lawrence Bobo  
*BS ‘58*  
Owner, Powder Metallurgy Company
James E. Furber  
'BS 64, MS '69  
Owner and President, Southwest Power, Inc.

Gil Heldenfels  
BS '85  
Vice President at Heldenfels Enterprises, Inc. (HEI)

Juan Manuel Lamparero  
BS '87  
Founding partner and CEO, Industrial Solutions Technology of Mexico

Dean Liollio  
BS '83  
President, PAA Natural Gas

James R. Porter  
BS '58  
CEO and President, Triad Systems

Jorge F. Quiroga Ramirez  
BS '81  
Former President of the Republic of Bolivia

Jack Scott  
MS '73  
 Founder and President Applied Systems and Technology Transfer  
Retired President and COO, Parsons

Alberto Aleman Zubieta  
BS '73  
Former CEO, Panama Canal Authority
VI.  A View to the Future

A. Challenges and Opportunities in the 25-by-25 Initiative

The goal of the 25-by-25 initiative, put simply, is to grow the College of Engineering’s student body (B.S., Masters, and Ph.D.) from 11,281 in 2012 to 25,000 in 2025. Dean Banks asked each department to form a growth committee and discuss whether an individual department has room to grow, and if so, how and how much.

To us, the first question for consideration is whether we still have room to grow, because unlike most of the other departments in the college (with Petroleum as an exception), ISEN has grown significantly in terms of student body and student-faculty ratio in the past eight years (see Figure 9 in Chapter IV, Section E). While the core faculty remains the same size as in 2005, the number of students (all included) has increased from 392 to 897, prior to the announcement of the 25-by-25 initiative. Since 2005 the department was able to absorb the growth without increasing resources in part because capacity was not completely utilized. So while it is at or near capacity today, new hires and new initiatives have been made and continue. The department’s Growth Committee is taking a very detailed look, to include building a simulation growth model, to guide our efforts.

A1. A Case for Growth

The Texas population is growing. According to the Texas Data Center and the Office of the State Demographer, the state’s population is projected to increase by 71.5 percent between 2000 and 2040, from 20.9 million to 35.8 million. The 2040 projected population of 35.8 million is a 151 percent increase from the 1980 population of 14.2 million. From 2004-5 to 2021-22, the number of high school graduates is projected to increase by 210,000 – about a 20 percent increase. Florida, Georgia, North Carolina and Texas account for most of the projected expansion, with the percentage of public high school graduates expected to rise by 40.1 percent in Texas. Then consider that the Texas Workforce Commission is projecting a 19 percent growth in engineering jobs in the next 12 years, which equates to more than 43,000 jobs.

We also looked at the U.S. Bureau of Labor and Statistics (BLS), specifically the BLS Occupational Outlook Handbook, 2010-2011, which forecasts a 6% increase in demand for industrial engineers through 2020. While that is the lowest forecast among the engineering fields, we see positive developments in the market.

One positive sign came during a recent advisory board meeting when one member pointed out that industrial engineers are more suited to his company’s needs than the petroleum engineers normally hired. Although his company is in the gas and oil business, it actually needs the flexibility and skills of industrial engineers. Why? Because engineers in his company start their careers as project managers then move to production operations before being promoted to management. An industrial engineer can learn the oil and gas business on the job, but the industrial engineering education
and training brings the skills essential for the company’s long-term needs. The individual who made this observation added that this change in hiring practices was spreading, and he was doing his part to help.

In other areas, like medicine, the trend is also toward an increased demand for industrial engineers. Industrial engineers are doing research in operating room scheduling, patient scheduling in cancer centers, and our own capstone design course has had projects that brought industrial engineering concepts to organize medical supply storerooms and led to a project the subsequent semester organizing the hospital’s entire warehouse. The demand for industrial engineering solutions in medicine have some projecting that every hospital in the U.S. will have an industrial engineer on staff in the next 10 years.

In the near term, the outlook remains positive for industrial engineers. The article, “Demand for Industrial Engineers Reaches a 4 Year High,” by Carolyn Menz at wantedanalytics.com states that hiring demand for industrial engineers was up 27% in February 2012 compared to February 2011 and up 207% from the recessionary low in June 2009. The top five metropolitan areas with hiring demand for industrial engineers included Houston, Texas, which is where many of our graduates head for their first job. Add to that the industrial engineer’s potential across a range of industries, and you find industrial engineers being sought in sectors that include service, financial, manufacturing, logistics, transportation, and even non-profits.

The demand in Houston was echoed in the very recent Houston Business Journal’s article, “Houston a top market for engineering jobs,” dated May 22, 2013. The article identifies that Houston was ranked as the number 1 market in the U.S. with the highest demand for engineers according to a new Monster Worldwide Inc., survey. The monster website (http://www.about-monster.com/content/monsteremployer-survey-indicates-higher-demand-engineering-jobs-2013) states, “Top 10 Markets for Engineering Jobs show strongest demand in Texas and California; Industrial and Mechanical engineers most sought.”

A2. Growth Plan and Challenges

With the demand for industrial engineers established, the next task was to define growth in terms of freshman enrollment. To determine the answer, we started with a baseline from Fall 2012, shown in the following chart.

Our current plan is to grow our undergraduate enrollment by 6% per year to reach our projected enrollment goal of 1,354 by the year 2025. Achieving the 2025 target requires jump-starting the initiative by setting the freshman capacity on admitted students for the Fall 2014 semester at 200 which assumes a 6% yield.
For our graduate programs, the growth engine will be our professionally-oriented master’s degree offering. Our intent is to offer the program both on campus and online. Properly designed and tailored, we expect to have 200 students enrolled in our distance learning program by 2018. The long-term goal for the master’s program (both in residence and distance learning students) is 410 enrolled students or a 130% increase.

Ph.D. program enrollment will remain proportional to the tenure-track faculty at a ratio of 3 to 1. Please note that our 2013 Ph.D. student-to-faculty ratio is 2.5, lower than the expected 3, suggesting extra difficulty in increasing the Ph.D. program even with a larger faculty size.

Calling what we are undertaking a paradigm shift is not an overstatement. To execute this growth plan does present challenges, and requires not only a curriculum review, a core skills crosswalk, a pedagogical shift, but also significant investment of time and resources; some of these are the ongoing work of the newly formed Growth Committee. The greatest challenge is how to manage the growth without overstressing the faculty, and how to handle the increased enrollment while maintaining consistent quality or even improving quality. In the subsequent section, we share our thoughts on how to address the challenges.
A3. Resources and Opportunities

While there are challenges associated with the 25-by-25 initiative and the growth plan, they also bring new resources and investments, thereby bringing unprecedented opportunities.

The first and foremost new investment is in faculty. To support our growth projections, we need 30 tenured/tenure-track faculty, an increase of 10 over our current number; 10 professors of practice, while maintaining the number of temporary/part-time teaching staff (in 2012, the baseline year, we had 2 lecturers, 1 adjunct professor and 4 senior professors who helped with teaching). We also expect the support staff increased by one to three new employees. The chart below illustrates what we request as necessary resources for our growth. If this level of faculty investment is given to us, by 2025, we should have 43 to 44 full-time instructional faculty (30 TTF, 13 to 14 full-time instructional), nearly doubling what we have now, which in principle allows us to manage the proportional growth in enrollments.

<table>
<thead>
<tr>
<th>Resources Request</th>
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</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Faculty</strong></td>
</tr>
<tr>
<td>Tenured/Tenure-Track</td>
</tr>
<tr>
<td>Professor of Practice</td>
</tr>
<tr>
<td>Instructors</td>
</tr>
<tr>
<td><strong>Staff</strong></td>
</tr>
<tr>
<td>UG Advising</td>
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<td>Graduate Advising</td>
</tr>
<tr>
<td>Distance Learning</td>
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<tr>
<td>Facilities</td>
</tr>
<tr>
<td>IT</td>
</tr>
<tr>
<td>Business</td>
</tr>
<tr>
<td>Support</td>
</tr>
<tr>
<td>Staff totals</td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
</tr>
<tr>
<td>Larger classrooms with a computer per student</td>
</tr>
<tr>
<td>Access to state-of-the-art, next generation manufacturing equipment</td>
</tr>
</tbody>
</table>

* Retired and not replaced

Hiring while implementing is a challenge, but one this department is up to. We have used instructional faculty for years and are already experienced and comfortable with
hiring from among the spectrum and poised to continue doing so. Additionally, there are local resources that offer industry experience among individuals with Ph.Ds. We just hired one of these individuals as our first professor of practice.

New tenure-track faculty (TTF) hiring will continue with the near-term focus on tenured, senior faculty candidates. In the current season, we are searching for two new faculty members who are at the full and associate professor levels. If actual growth matches -- but especially if it exceeds projections -- we envision hiring one non-TTF instructional faculty member for every TTF hire. From this range of options, we see strength and flexibility to meet demand.

Our approach to the anticipated growth is not based exclusively on hiring new employees. We also intend to explore opportunities for employing resource multipliers; for instance, the one we currently have in our writing center (Chapter I, Section E1) is an example. Using an existing campus resource, the University Writing Center (UWC), the director of our writing center started recruiting our students to become certified undergraduate writing assistants. The training and certification is done in one semester at the UWC, and then the students return to assist with our W (writing intensive) courses, other courses with writing assignments, and staff our own writing center to help with the students who come for help with an assignment or other writing such as resumes, cover letters, and internship applications. The service extends to Ph.D. students who are writing articles or working on their dissertation.

So where is the resource multiplier? With five trained UWAs, one faculty member is able to support and assist roughly 400 students per semester. We see potential in this model in applications like student advising and recruiting. Upper-level undergraduates could be trained and provide key assistance in both these areas. Both studies and practical experience show that students are very effective in positions like this at both reducing the workload for employees and being paid attention to by peers.

One important apparatus to help us handle an increased enrollment is to capitalize on technology. Our faculty has received training on the new eCampus system and a presentation on flipping courses by a practitioner with over five years’ experience flipping engineering courses. The eCampus provides key features that support faculty initiatives to alter the classroom to enhance their own efficiency and our students’ learning experience. The eStudio we have in the department consists of a soundproof booth equipped with the latest technology and software to support faculty and students with a need for this capability.

Labs are not an issue for us. Classroom space will be. Already our largest classrooms cannot accommodate the current enrollment and courses have been divided into sections that meet separately. We need classrooms with computer access that can accommodate 100 or more students. We will participate in developing several shared laboratories.
B. Goals and Strategies

With the growth occupying the faculty’s attention, we need to be mindful of several important, overarching goals that need to be achieved for the long-term health of our academic program, regardless the growth. The following outlines the four major thoughts.

- Increase our research productivity

It is obvious that a major weakness of this department is its relatively low research expenditure, even after the faculty has substantially improved the per-faculty spending in the past decade. This challenge is not unique to this ISEN department but common to the entire ISEN field. Industrial Engineering, and now Industrial and Systems Engineering, as a discipline has faced a number of challenges over the last decade when the severe decline in U.S. manufacturing capability has forced our discipline to pursue research and funding opportunities beyond our traditional application areas. The results are mixed, primarily because it takes time for ISEN to establish credibility and a sense of ownership outside the traditional areas. The financial crisis in 2008 and the subsequent federal budget reduction made the funding situation more challenging.

Our goal here is to continue or even accelerate the trend of research expenditure increase and try to double our per faculty expenditure again by 2020, to the level of $160K per faculty per year. This expenditure level will get our department close to the college’s average.

Our strategy to achieve this goal is to build critical masses of faculty expertise that distinguish us from the other ISEN programs and are relevant to Texas’s economy. The key question that guides us in the faculty hiring process is – what do we want us to be known for? We believe that the faculty resources promised for executing the growth present an unprecedented opportunity that will not come again. So we will have to make good use of it. If our hiring successfully answers the key question, this ISEN department has the potential to compete for a top-five ISEN department national ranking in ten years.

In the meanwhile, the growth provides a number of other opportunities. One is the Chancellor’s Research Initiative (CRI). CRI provides Texas A&M University a significant amount of funding for the recruitment and hiring of key faculty who will have a transformative impact upon the university’s academic and research missions. The department has been actively identifying top performers from the ISEN discipline to compete for such positions.

Another opportunity is the One Health Grand Challenge, which is to plan and implement an inter/trans-disciplinary collaborative approach to help assure healthy humans, animals and an equally healthy environment. The Texas A&M College of Engineering is a key player in One Health and has received funding for multiple faculty positions that can be allocated to any engineering department. These faculty positions will come as
resources to the hiring department in addition to the existing allocations. Healthcare is an important emerging area in the ISEN discipline, and is indeed one of the areas this department wants to build a critical mass in. Our department has recently sent the college a potential candidate’s name for this initiative and has received permission to interview that individual.

The third opportunity is the TIAS Fellow program. TIAS stands for Texas A&M University Institute for Advanced Study, that was created to provide a catalyst for enriching the intellectual climate and educational experiences at Texas A&M. Each year TIAS invites a number of nationally and internationally prominent Faculty Fellows to pursue advanced study at TIAS in collaboration with faculty and student scholars at Texas A&M. The goal is to provide a stellar environment for research and scholarship with the Faculty Fellows having the freedom to pursue their own research interests as well as collaborate in disciplinary and multidisciplinary research. In the Fall of 2013, the ISEN department nominated a colleague, whose expertise is in health care, to fill one of these positions. If this nomination is selected and the candidate accepts the invitation, the candidate will come to work at Texas A&M for up to 12 months. We believe that this program will foster future collaboration opportunities between the ISEN faculty and the TIAS Fellow, as well as bring visibility to the department and the college.

- Enhance the Ph.D. program.

As noted in Chapter III, Section K, our Ph.D. program recently experienced a downsizing, and the number of our current Ph.D. students is at the lowest level in a decade. As a result of the smaller Ph.D. program, the faculty finds it difficult to offer specialized, in-depth Ph.D. level courses, especially after the college recently increased the minimum number of students required for a graduate course from 5 to 8. In the same time, however, the Graduate Committee recommended a more structured degree requirement that includes a set of advanced course work for all Ph.D. students. The temporary solution is to direct our students to take advanced courses offered by other departments such as computer science, mathematics, statistics, and economics.

Our goal for Ph.D. program enhancement is not only about quantity but also about quality, of which a measure is our placement of Ph.D. graduates in peer institutions. We wish to achieve these three goals for our Ph.D. program in the next five years:

1. Increase the size of Ph.D. program, and maintain roughly three Ph.D. students per tenured/tenure-track faculty member.
2. Increase the number of domestic Ph.D. students in our program.
3. Attain a better outcome in terms of student placement in peer institutions.

Maintaining a 3-1 student-faculty ratio in our Ph.D. program is challenging. Our recent admission data indicates that we have a reasonably good pool of applicants. However, without financial support, students will not likely commit themselves to pursuing a Ph.D. with us. To have three students per faculty implies that in a steady state, if the department supports one student per faculty using teaching assistantship positions,
each faculty member should, on average, support two students with their own research funding. Our current research productivity lags behind this goal; the current number is roughly one student supported per faculty member. Faculty productivity has a greater implication on the size of the Ph.D. program than might be immediately apparent. The department relies heavily on the faculty research in the form of indirect returns available to support students on teaching assistantships. The current level of indirect returns can only support about 50% of the TAs. To achieve a 3-1 ratio in our Ph.D. program, the research productivity goal stated above is essential.

Increasing the domestic students in our Ph.D. program continues to be a challenge. According to the data in Chapter V, Section A2, the portion of domestic students in our Ph.D. program, averaged over the past five years, is 33%. We hope that this portion can go up to 50%, and we also hope to attract quality, competitive domestic students. One of the reasons that the domestic student portion sees a decrease in recent years is because a large percentage of domestic students failed the Ph.D. qualifying exam and were dismissed from the program. The simple lesson and one we need to remember is that an increase in domestic students cannot be sustained if we do not recruit quality applicants.

To recruit quality applicants, resources such as prestigious fellowships and sustained funding are critical. Although we have made substantial progress in our development, securing endowments for graduate support is always more difficult than for undergraduate opportunities. Donors like to give to the program they graduated from or to professors from whom they took classes. While we have to work hard to secure endowed funding for graduate fellowships, in the short term, the department is trying to leverage this effort with other resources.

In the Fall 2013 semester, Dr. Malavé used his endowed chair fund to create two department-level graduate fellowships that allow more flexibility and freedom for the Graduate Committee to recruit strong candidates. To accommodate possibly more quality applicants, we will always make use of the university’s Merit and Diversity Fellowships. We were able to submit successful application packages in the past few years to get three to five Merit and Diversity Fellowships every year. Where we fall short, however, is getting these top applicants to enroll at Texas A&M. Last year (2012-13 season), for instance, we were awarded three Merit Fellowships, but none of the recipients chose to join Texas A&M. We are still trying to figure out how we can change this low percentage of acceptance from our fellowship recipients. We will continue to reach out and make personal connections with the students through phone calls and visits, but explore mechanisms to create compelling financial offers to accompany the personal touch.

Ph.D. student placement, particularly as faculty at peer universities, continues to be a major goal. We had some limited success in the recent years: an incomplete tally yields fourteen academic placements since 2008 (six in the U.S., two in Puerto Rico, one in Mexico, four in South Korea, one in Taiwan). Counting 46 Ph.D. graduates in the same period, this translates to about 30% of Ph.D. students being placed in academia,
a percentage we would like to increase. More importantly, the number of students placed in peer institutes is small.

While attracting top students and getting the best-of-the-best to attend Texas A&M is a start in this process, we must do more to prepare our students for faculty careers and get them thinking about their career path earlier in their education process. We provide a solid technical education. But our students need to have stronger publication records to be competitive in the job market. As shown in Chapter V, Section A8, our students are indeed publishing before they graduate. Still there is room for improvement, in terms of both where the papers are published and how many are finished prior to getting into the job market. In the meanwhile, we need to continue our career development programs to help our Ph.D. students with the “other education” needed to attain top faculty positions and succeed once the positions are attained.

- Elevate the faculty visibility within our professional societies

Related to the question of Ph.D. student placement, one critical factor is the visibility of the faculty, which in part depends on faculty’s research productivity.

The department has been using a number of mechanisms to boost faculty visibility in the recent years. Even in hard economic times, the department has continued to provide travel support to encourage participation of faculty in professional societies and national and international conferences. In fact, the travel fund has increased from $1,500 per faculty to $2,000 in the Fall 2013 semester.

TIAS Fellow program is another resource the department is trying to make use of for attracting high-profile, national academies caliber, IE-related researchers to spend one year in residence at Texas A&M, and work with the ISEN faculty and students. This will not only improve the department’s visibility but also could jump start potential collaborations leading to new research and funding opportunities.

The department is constantly promoting its own faculty to the society’s leadership positions. The departmental Award Committee works diligently to nominate eligible faculty members for Fellowship at IIE and INFORMS, as well as other relevant, noteworthy research and achievement awards in our field. The department provides incentive for faculty members to lead major national conferences such as being the General/Program Chair of ISERC.

The ISEN seminar course has continued to be an important platform for us to invite and engage the top researchers in our field. In the past two years, working with ADVANCE center, the department hosted six prominent female speakers each year from the ISEN field to present their research at our seminar series.

As our associate professors and young full professors become leaders in the field, we believe that the department’s visibility will rise with it. Our goal is to have, in the period until the next academic program review, at least an editor-in-chief in one of the major
IE/INFORMS journals, at least one general program chair for a major national conference, and at least one officer at the governing board level of IIE and/or INFORMS.

- Modernize the undergraduate curriculum

It is probably a time for all of us in the industrial and systems field, not necessarily only the ISEN at Texas A&M, to re-examine IE, especially the undergraduate curriculum, which we have taught for the past twenty plus years. The 2000 ABET guideline allows individual programs to amend their own curriculum to meet the new needs. According to exit interviews with our students and market place surveys with employers, there was a sense that some of the components in the IE undergraduate curriculum have lagged behind what the workplaces desire. One case in point is that in one of the recent INFORMS panel discussions on Industrial Practices and Needs, tools for data mining or skills of data analytics were identified as one of the most critical skills needed in practice. Yet, our current curriculum has taught our students a very limited viewpoint in terms of data analysis, and equipped them with primarily the tool of control charts (sometimes ANOVA), despite that various versatile, more capable data-mining tools were made available in the past fifteen years.

Injecting a change into the curriculum does not appear a simple undertaking. Through the ABET evaluation cycles, changes did get made but usually in the form of incremental patchwork to the current curriculum. The departmental Undergraduate Committee has been charged and has been working since Fall 2012 on establishing the fundamentals for a new, 21st century-oriented IE curriculum. While the Undergraduate Committee’s work is still ongoing, we can gather the following key thoughts from the work-in-progress. The committee’s approach to the charge is outlined below:

1. Review curricula of peer and better departments;
2. Identify major core skill sets for successful industrial and systems engineers (content);
3. Consider appropriate mathematics/general engineering background;
4. Integrate ISEN technical electives and other important experiential learning opportunities;
5. Develop concept map to assist in course development and staging; and
6. Consider formats other than traditional semester-long classes.

The committee also laid out the overarching principle as:

*Senior design project should pull together all aspects of the curriculum (conceptualization, technical analysis, judgment, team execution). Systems engineering provides an excellent framework within which to view engineering in general and industrial and systems engineering in particular.*

With the approach and principle laid out, the Undergraduate Committee has identified the major skill sets for successful industrial and systems engineers:
1. Computational tools and software
2. Data analytics
3. Economics-finance-management
4. Human factors
5. Operations analysis
6. Systems engineering
7. Uncertainty and risk.

Currently, the Undergraduate Committee is working to establish a skill set concept inventory and map the core concept inventory to courses in the undergraduate curriculum. A final committee report is due by the end of AY 2013-14.

A great resource relevant to revamping the undergraduate curriculum is the Center for Teaching Excellence (CTE) which has program specialists that are specially focused on curriculum revisions. ISEN will take full advantage of the CTE expertise in this effort when needed.

Other than re-examining the IE undergraduate curriculum, the department is also contemplating opportunities for high-achieving students, through a program known as ELITES Fellows program. ELITES is an acronym that identifies the six types of opportunities (see the following chart) we want to provide our undergraduate students, in addition to what they already receive through their coursework. The ELITES Fellows Program is in its infancy, but we want to establish a program that allows motivated students to seek more challenging opportunities that will distinguish them and their work as undergraduates and provide experience beyond that of their peers.

**ELITES FELLOWS PROGRAM**
• Final Note on Development and Endowment

As a final note to what we are doing and planning to do, the issue of resources is always coming to the center position. For faculty development, resources are needed; for research initiatives, seed money is necessary; for faculty recognition, professorships are a must; for recruiting top Ph.D. students, graduate fellowships must be in place; for undergraduate study abroad and other international experiences, it would be nice if there were sufficient subsidies to broaden participation. All these needs probably explain why in the past decade, the role of development has shifted down to the departmental level.

At this point the department has a healthy endowment fund. More importantly, the department leadership has learned valuable lessons in securing endowments from past experiences. Currently, the department has a development goal of increasing our endowment level an order of magnitude in ten years. It is ambitious, but it recognizes that external financial support is necessary to underwrite the department's goals.
Appendix A

Industrial and Systems Engineering

18 Characteristics of Texas Public Doctoral Programs
(2012)
### Texas A&M University

**18 Characteristics of Texas Public Doctoral Programs**

Programs included only if in existence 3 or more years. Program is defined at the 8-digit CIP code level.

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<thead>
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<th>Industrial and Systems Engineering</th>
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<td>Doctoral Degree Program</td>
<td>Industrial Engineering</td>
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<tr>
<td>Contact Name</td>
<td>Yu Ding</td>
</tr>
<tr>
<td>Contact Phone Number</td>
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#### 1. Number of Degrees Per Year

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<tr>
<td>2010-2011</td>
<td>8</td>
</tr>
<tr>
<td>2011-2012</td>
<td>10</td>
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<td>3 Year Average</td>
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#### 2. Graduation Rates

Starting Cohorts: 2000-2002

<table>
<thead>
<tr>
<th>Percentage Graduating within 10 Years</th>
<th>Years with Cohort greater than 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>71.88%</td>
<td>2000, 2001, 2002</td>
</tr>
</tbody>
</table>

#### 3. Average Time to Degree

Students Starting 2000-2002

<table>
<thead>
<tr>
<th>Average Years to Degree</th>
<th>5.29</th>
</tr>
</thead>
</table>

#### 4. Employment Profile

(In field within one year of graduation). For each of the three most recent years, the number and percent of graduates by year employed, those still seeking employment, and unknown

<table>
<thead>
<tr>
<th>Year</th>
<th>Employed</th>
<th>Percent</th>
<th>Still Seeking</th>
<th>Percent</th>
<th>Unknown</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2009</td>
<td>10</td>
<td>90.9</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>9.1</td>
</tr>
<tr>
<td>2009-2010</td>
<td>7</td>
<td>87.5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>2010-2011</td>
<td>6</td>
<td>75</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>2011-2012</td>
<td>9</td>
<td>90</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

#### 5. Admissions Criteria

Description of admission factors

- Graduate GPR>3.5, UG GPR>3.0
- Good grades in math and statistics courses
- GRE Verbal>400
- International

#### 6. Percentage Full-time Students

FTS/number of students enrolled for the last three fall semesters.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall 2010</th>
<th>Fall 2011</th>
<th>Fall 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>89.8%</td>
<td>84.5%</td>
<td>88.7%</td>
</tr>
</tbody>
</table>

#### 7. Average Institutional Financial Support Provided

For those receiving financial support, the average monetary institutional financial support provided per full-time graduate student for the prior year, from assistantships, scholarships, stipends, grants, and fellowships. Does not include tuition or benefits.

$13,674.00

#### 8. Percentage Full-Time Students with Institutional Financial Support

In the prior year, the number of full-time students with at least $1,000 of annual support/the number of full-time students

98.00%

#### 9. Number of Core Faculty

Number of core faculty in the prior year

18
<table>
<thead>
<tr>
<th>10</th>
<th>Student-Core Faculty Ratio</th>
<th>3.2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three-year average of full-time student equivalent (FTSE) /three-year average of full-time faculty equivalent (FTFE) of core faculty. Core Faculty: Full-time tenured and tenure-track faculty who teach 50 percent or more in the doctoral program or other individuals integral to the doctoral program who can direct dissertation research.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>11</th>
<th>Core Faculty Publications</th>
<th>1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three-year average of the number of discipline-related refereed papers/publications, books/book chapters, juried creative/performance accomplishments, and notices of discoveries filed/patents issued per year per core faculty member.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12</th>
<th>Core Faculty External Grants</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three-year average of the number of core faculty receiving external funds, average external funds per faculty, and total external funds per program per academic year. All external funds received from any source including research grants, training grants, gifts from foundations, etc., reported as expenditures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average of the Number of Core Faculty receiving</td>
<td>17.33</td>
</tr>
<tr>
<td></td>
<td>Average External Funds per Faculty</td>
<td>$ 102,749.00</td>
</tr>
<tr>
<td></td>
<td>Total External Funds</td>
<td>$ 1,781,881.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13</th>
<th>Faculty Teaching Load</th>
<th>51.6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total number of semester credit hours in organized teaching courses taught per academic year by core faculty divided by the number of core faculty in the prior year</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>14</th>
<th>Faculty Diversity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core faculty by ethnicity (White, Black, Hispanic, Other) and gender, updated when changed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>White</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15</th>
<th>Student Diversity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enrollment headcount by ethnicity (White, Black, Hispanic, Other) and gender in program in the prior year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fall 2012</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>White</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>28</td>
<td>18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>16</th>
<th>Date of Last External Review</th>
<th>2005-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date of last formal external review, updated when changed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>17</th>
<th>External Program Accreditation</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name of body and date of last program accreditation review, if applicable, updated when changed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>18</th>
<th>Student Publications/Presentations</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For the three most recent years, the number of discipline-related refereed papers/publications, juried creative/performance accomplishments, book chapters, books, and external presentations per year by student FTE</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Weave Online Entries for Industrial and Systems Engineering Graduate Programs
B1. Ph.D. program

1. Mission / Purpose

Provide education, research, and professional service programs in industrial and systems engineering that contribute to the economic and technological advancement of our state, the nation, and the world.

2. Goals

- Attract high quality graduate students: Provide outstanding education and research programs in industrial and systems engineering that will attract high quality students from the state and worldwide.

- Attract and retain faculty of the highest quality: Attract and retain faculty of the highest quality, and provide them with resources and opportunities to become national and international leaders in their professions.

- Furnish students with opportunities to learn: Furnish graduate students with opportunities to learn and practice the technical, communication, decision making, and management skills necessary to be successful in their engineering careers.

3. Outcomes/Objectives

- Attract high quality students into the Ph.D. degree program.
- Basic knowledge: Graduates will be able to demonstrate basic industrial engineering knowledge.
- In-depth knowledge: Students will demonstrate an in-depth knowledge of their chosen area within industrial engineering.

4. Measures

- Dissertation/Thesis: Write and successfully defend the dissertation or thesis (measure the in-depth knowledge). All graduating students must successfully defend their dissertation research.

- Qualifying Exam: A departmental qualifying examination covering basic knowledge within industrial engineering will be given to all Ph.D. students (measure the basic knowledge). All Ph.D. students must pass the qualifying examination to continue in the Ph.D. program.
• Preliminary Examination. A preliminary examination that covers all courses on their degree plan will be given to all Ph.D. students (measure the in-depth knowledge). All Ph.D. students must pass the preliminary examination to continue.

• GPR and GRE test scores: All applicants will report GRE test scores and undergraduate/graduate grade point averages (measure the incoming student quality). In our admits we want 75% to have a master’s GPA of 3.5 –OR– an undergraduate GPA of 3.4. 90% of students will meet the minimum English Language Verification requirements of either GRE-V 146, TOEFL 80, or undergraduate/graduate degree from a US institution, IELTS score of 6.0. Also, 75% of students will have a GRE-Quantitative score of 159 or higher.

B2. Master of Science program

1. Mission / Purpose

Provide educational and professional service programs in industrial and systems engineering that contribute to the economic and technological advancement of our state, the nation, and the world.

2. Goals

• Attract the best graduate students: Provide outstanding education and research programs in industrial and systems engineering that will attract the best undergraduate students.

• Furnish students with opportunities to learn: Furnish graduate students with opportunities to learn and practice the technical, communication, decision making, and management skills necessary to be successful in their engineering careers.

• Prepare for the Ph.D. Program: The Master of Science program should prepare students for entry into the Ph.D. program.

3. Outcomes/Objectives

• Basic knowledge: Graduates will be able to demonstrate a basic knowledge of industrial engineering.
• Students in a position to apply to Ph.D. Programs: The better students within the Master of Science program should be in a position to apply and be accepted into Ph.D. programs.

4. Measures

• Overall grade point average: Students must receive at least a 3.0 grade point average over their course work and over their degree plan (measure basic knowledge). 100% of graduating students have a degree plan GPA of at least 3.00.

• Percent with high GPA: The proportion of our graduating students who have the academic GPA necessary for a successful application to a Ph.D. program (measure students in a position to apply to Ph.D. programs). Twenty-five percent of the graduating students should achieve an overall GPA of at least 3.25 (the standard minimum GPA for entering our own Ph.D. program).

• Performance during final oral examination. All students must take a final oral examination over their course work or thesis research (measure the basic knowledge). All students must pass the final oral examination.

B3. Master of Engineering program

1. Mission / Purpose

Provide educational and professional service programs in industrial and systems engineering that contribute to the economic and technological advancement of our state, the nation, and the world.

2. Goals

• Furnish students with opportunities to learn: Furnish graduate students with opportunities to learn and practice the technical, communication, decision making, and management skills necessary to be successful in their engineering careers.

3. Outcomes/Objectives

• Basic knowledge: Graduates will be able to demonstrate a basic knowledge of industrial engineering principles and evidence of use in practical situations.
4. Measures

- Overall grade point average: Students must receive at least a 3.0 grade point average over their course work and over their degree plan. (measure basic knowledge). All (100%) graduating students have at least 3.00 degree plan GPA.

B4. Master of Science program for Engineering Systems Management

1. Mission / Purpose

Provide educational and professional service programs in industrial and systems engineering that contribute to the economic and technological advancement of our state, the nation, and the world.

2. Goals

- Provide opportunities to learn through distance education: Furnish graduate students with distance educational opportunities in the field of engineering systems management.

3. Outcomes/Objectives

- Basic knowledge: Graduates will be able to demonstrate a basic knowledge in management and systems engineering principles.

4. Measures

- Performance during the final examination: All students must take a final oral examination over their course work (measure basic knowledge). All students must pass the final oral examination.
Appendix C

Faculty Curriculum Vitae
Mark S. Avnet
Assistant Professor

Years of Service at Texas A&M: 1

Professional Experience

Texas A&M Univ, Dept. of Industrial & Systems Engineering
Assistant Professor
College Station, TX
August 13 – Present

- Research: Complex socio-technical systems, shared knowledge in teams and organizations, cognitive and organizational aspects of systems engineering, organizational behavior and culture, process optimization and task allocation, implications of social networks for organization design and facilities layout
- Teaching: ISEN 411 Engineering Management Techniques (Fall 2013); ISEN 689 Management of Engineering Systems (planned Spring 2014)

McKinsey & Company
Engagement Manager
New York, NY
July 09 – August 13
- Advised clients on critical operational improvement problems, particularly in performance transformations across manufacturing, product development, procurement, and related organizational issues (performance management, mindsets and behaviors, and capability-building)

National Aeronautics and Space Administration, Headquarters
Program Specialist
Washington, DC
October 04 - August 05
- Developed rules and technical specifications for technology demonstration competitions intended to stimulate advanced technology development in the private sector

NASA Ames Research Center
Visiting Researcher
Moffett Field, CA
May 04 - June 04
- Conducted a study on the technical, economic, and political feasibility of the space elevator

Rocket Software, Inc.
Software Developer
Newton, MA
August 01 - August 03
- Designed, developed, and deployed DB2 Recovery Expert for Multiplatforms, a tool that recovers lost and corrupted databases, database objects, and data for IBM’s database management system (DBMS), bringing version 1.1 from conception to market

Education

Massachusetts Institute of Technology
Ph.D. in Engineering Systems
Cambridge, MA
Graduated June 09

George Washington University, Elliott School of International Affairs
M.A. in Science, Technology, and Public Policy
Washington, DC
Graduated May 05

University of South Australia
Graduate Certificate in Applied Science
Adelaide, Australia
Conferred August 04

Massachusetts Institute of Technology
S.B. in Physics with a minor in Spanish
Cambridge, MA
Graduated June 01
Publications


Conference Papers


Honors/ Awards
NSF Integrative Graduate Education and Research Traineeship (IGERT), MIT Program on Emerging Technologies (PoET);
NASA Graduate Student Research Ambassador to the 2006 International Astronautical Congress (IAC);
Lockheed Martin Fellowship;
NASA District of Columbia Space Grant Fellowship;
Elliott School Honors Fellowship

Languages
Spanish
Amarnath Banerjee  
Associate Professor

Ph.D., Industrial Engineering and Operations Research, University of Illinois - Chicago, 1999  
B.S., Computer Science, Birla Institute of Technology and Science, India, 1989  

**Years of Service at Texas A&M:** 14

**Professional Experience:**

Associate Professor, Industrial and Systems Engineering, Texas A&M University, 2005-

Assistant Professor, Industrial Engineering, Texas A&M University, 1999-2005

Research Programmer, Mechanical and Industrial Engineering, University of Illinois – Chicago, 1998-1999

Research and Teaching Assistant, Mechanical and Industrial Engineering, University of Illinois – Chicago, 1993-1998


**Principal Publications:**


**Professional Societies:** IIE (Senior Member), IEEE, INFORMS, HIMSS, SHS
Awards & Honors:

Charles W. Crawford Service Award, 2012-13, 2008-09  
William O. and Montine P. Head Faculty Fellow, 2011-12, 2008-09  
NASA Tech Brief Award for the project Virtual Video for Remote Cockpit Design, 2009  
Montague Center for Teaching Excellence Scholar, 2004

Professional Service:

Track Coordinator, Rural Health (new track), INFORMS Conference on Healthcare, Chicago, IL, 2013  
Board Member (elected), Computers and Information System, Institute of Industrial Engineers, 2012-2014.  
Board Member (elected), Health Systems Engineering Alliance, an association of academic programs conducting research and offering education curricula focused on engineered solutions to the abundant operational and process challenges of current health promotion and delivery systems, 2012-2013.  
Co-chair, Tuning Oversight Council for Engineering, advising Texas Higher Education Coordinating Board in integrating the “Tuning” process for course alignment in Industrial Engineering, 2010-2011.  
Associate Editor, IIE Transactions on Healthcare Systems Engineering  
Associate Editor, SME Journal of Manufacturing System

Reviewer:  
Applied Ergonomics  
ASME Journal of Manufacturing Science and Engineering  
Computers and Industrial Engineering  
Decision Support Systems  
Engineering Applications of Artificial Intelligence  
IEEE Transactions on Automation and Sciences in Engineering  
IEEE Transactions on Information Technology in Biomedicine  
IEEE Transactions on Robotics and Automation  
IEEE Transactions on Systems, Man and Cybernetics – Part A  
IEEE Transactions on Systems, Man and Cybernetics – Part C  
IIE Transactions  
IIE Transactions on Healthcare Systems Engineering  
International Journal of Advanced Manufacturing Technology  
International Journal of Modelling and Simulation  
International Journal of Production Research  
Journal of Intelligent Manufacturing  
Smart Materials and Structures  
SME Journal of Manufacturing Systems  
Virtual Reality
Satish T.S. Bukkapatnam  
Rockwell International Professor

Ph.D. Industrial and Manufacturing Engineering, Pennsylvania State University, University Park
M.S. Industrial and Manufacturing Engineering, Pennsylvania State University, University Park
B.S. Mechanical Engineering S.V. University Tirupati, India

Years of Service at Texas A&M: 1

Professional Experience:
AT&T Professor of Engineering, Oklahoma State University, 2011-2013
Professor of Industrial Engineering and Management, Oklahoma State University, 2009-current
Associate Professor of Industrial Engineering and Management, Oklahoma State University, 2004-2009
Assistant Professor of Industrial and Systems Engineering, University of Southern California, 1997-2004

Principal Publications:


Professional Societies: IIE, INFORMS, IEEE, SME

Professional Service:
Co-Chair, NSF Workshop on Advanced Machine Tool Research 1999.

Chair of the 200+ member Quality, Statistics and Reliability (QSR) Section, Institute of Operations Research and Management Science (INFORMS) 2007-08

Co-Chair, Industrial Engineering Research Conference (IERC 2003, Organizing Committee member for 2005,

Process Track Coordinator and Communication Chair of IIE Manufacturing Division 2000-03. Scientific Committee Member of SME NAMRI 2000-05.

Department/Associate Editor for IIE Transactions (focused issues on Quality and Reliability Engineering (QRE) and Manufacturing and Design (MD)), Computers in IE, International Journal of Quality, Statistics and Reliability

Awards and honors:
OSU Regents Distinguished Research Award, 2011
Hamed K. Eldin IIE Outstanding Young Faculty Educator Award, 2012
Halliburton Outstanding Faculty, Oklahoma State University, (Young 2011, Senior 2012)
SME Doherty Outstanding Young Manufacturing Engineer: Selected for year 2005
Best Teacher Award: Elected Alpha-Pi-Mu Omega-Rho Teacher of the Year for 2001-02
Epstein Department of Industrial and Systems Engineering, University of Southern California Fellowships: Zumberge Fellow for 1998-99, SC2 Junior Faculty Fellow, 1999, Powell Foundation Fellow 2001-03, University of Southern California Best Paper Awards: EMS-IEH best innovation award 2013,
IIE Research Conference (Manufacturing Division, CIS Division), 2009, 2010, 2011,
IIE CIEDAH Best Student Poster Award (for advisee) 2011,
TSL Society, INFORMS for publication in Transportation Science Journal 2007,
Novel Applications, Artificial Neural Networks in Engineering Conference 1994,
Finalist in the Student paper competition for INFORMS QSR section best student paper award competition 2009

Reviewer (select):
IIE Transactions on Quality and Reliability Engineering
IIE Transactions on Manufacturing and Design
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Neural Networks
ASME Journal of Manufacturing Science and Engineering
Physical Review E
Electrocardiology Journal
Ph.D., Industrial and Systems Engineering, University of Florida, 2003  
M.S., Industrial and Systems Engineering, University of Florida, 2001  
M.S., Mathematics, Kyiv National Taras Shevchenko University, Ukraine, 1999  
B.S., Mathematics, Kyiv National Taras Shevchenko University, Ukraine, 1998

**Years of Service at Texas A&M:** 10

**Professional Experience:**

Associate Professor, Industrial and Systems Engineering, Texas A&M University, 2009-
Assistant Professor, Industrial and Systems Engineering, Texas A&M University, 2003-2009
Graduate Assistant, Industrial and Systems Engineering, University of Florida, 1999-2003

**Selected Recent Publications:**


**Professional Societies:** AMS, IIE, INFORMS, MOS, SIAM

**Awards & Honors:**

Donna and Jim Furber ’64 Faculty Fellow in Industrial and Systems Engineering, TAMU, 2013-2015.

Charles H. Barclay, Jr. Faculty Fellow, Dwight Look College of Engineering, TAMU, 2012.

Young Investigator Program Award, Air Force Office of Scientific Research, 2008.

2005-2006 “Favorite Professor of the Year”, IIE Student Chapter, TAMU, 2006.

**Selected Professional Service:**

Editor-in-Chief, *Journal of Global Optimization*, since 01/01/2013.
Editorial Board Member, *Journal of Combinatorial Optimization* (since 2007)
Editorial Board Member, *Optimization Letters* (since 2006)
Editorial Board Member, *Computational Management Science* (since 2005)
Co-organizer of *NATO Advanced Research Workshop: Examining Robustness and Vulnerability of Critical Infrastructure Networks*, Kyiv, Ukraine, June 3-5, 2013
Member of the program committee, *4-th Annual International Conference on Combinatorial Optimization and Applications (COCOA’10)*, The Big Island, Hawaii, December 18-20, 2010
Co-organizer of *Yalta Optimization Conference: Network Science*, Yalta, Ukraine, August 2-4, 2010
Member of the program committee, *3-rd Annual International Conference on Combinatorial Optimization and Applications (COCOA’09)*, Yellow Mountains, China, June 10-12, 2009
Member of the organizing and scientific committee, *International Conference on Economics, Management, and Optimization in Sports*, Barcelona, Spain, December 1-3, 2009
Co-organizer of *Yalta Conference on Discrete and Global Optimization*, Yalta, Ukraine, July 31 - August 2, 2008
Co-organizer of *DIMACS Workshop on Clustering Problems in Biological Networks*, Rutgers University, Piscataway, NJ, May 9-11, 2006
Mentored two undergraduate student participants of TAMUS Louis Stokes Alliance for Minority Participation (LSAMP), 2008-2009
Mentored four secondary school science and math teachers participating in the NSF-sponsored summer Enrichment Experiences in Engineering E³ program, Dwight Look College of Engineering, 2005-2006
Reviewer for *Mathematical Reviews*, American Mathematical Society
Sıla Çetinkaya
Professor and Associate Head

Ph.D., Management Science, McMaster University, 1996
M.Sc., Industrial Engineering, Bilkent University, 1991
B.Sc., Industrial Engineering, Istanbul Technical University, 1989

Years of Service at Texas A&M: 16

Professional Experience
TAMU
Associate Head, Industrial and Systems Engineering, TAMU, 2013 –Present
Professor, Industrial and Systems Engineering, TAMU, 2009 –2013
Associate Professor, Industrial Engineering, TAMU, 2003 – 2009
Assistant Professor, Industrial Engineering, TAMU, 1997-2003

Other
Visiting Professor, Industrial Engineering, Koç University, March-August 2013
Visiting Faculty, Industrial and Systems Engineering, University of Florida, April 2006
Visiting Scholar, Industrial Engineering and Engineering Management, Hong Kong University of Science and Technology, May 2002

Principal Publications (most recent five)

Professional Societies - IIE, INFORMS, ISA (Industry Studies Association), EURO Working Group on Stochastic Modeling, YAD (Turkish OR Society)

Awards & Honors
Selected National Level Recognition
- IIE Fellow, Institute of Industrial Engineers, 2012.
- Outstanding Young Industrial Engineer, Institute of Industrial Engineers, 2003.
- CAREER Award, National Science Foundation, 2001–2006.
Selected TAMU Recognition
- William O. and Montine P. Head Faculty Fellow, 2011.
- TEES Fellow, 2006.
- Dwight Look College of Engineering Fellow, 2006.

Professional Service
- Program Chair - ISERC 2015, IIE Annual Conference and Expo, Location: TBD.
- Co-chair, Doing Good with Good OR Student Paper Competition, INFORMS, 2012.
- Co-chair, Interactive Sessions, INFORMS, Austin, Texas, 2010.
- Cluster Chair, MSOM Supply Chain, INFORMS, Austin, Texas, 2010.
- Department Editor, Supply Chains, IIE Transactions on Scheduling and Logistics, since 2006.
- Associate Editor, Naval Research Logistics, since 2006.
- Editorial Board Member, International Journal of Inventory Research, since June 2005.
- Review Committee Member, APMS International Conference Sustainable Production and Service Supply Chains, 2013.
- Awards Committee Member, Doing Good with Good OR Student Paper Competition, INFORMS, 2011, 2013.
- Review Committee Member, Student Paper Competition, POMS College of Supply Chain Management, 2009.
- Panelist (dates confidential), National Science Foundation.
- Proposal Reviewer (dates confidential):
  - Dutch Research Council,
  - Israel Research Foundation,
  - Hong Kong Research Grants Council,
  - Louisiana Board of Regents, and
  - The Netherlands Organization for Scientific Research.

Guy L. Curry
Professor

Ph.D., Industrial Engineering, University of Arkansas, 1971
M.S., Mathematics, Wichita State University, 1967
B.S., Mathematics, University of Oklahoma, 1963

Years of Service at Texas A&M: 42

Professional Experience:

Professor, Industrial Engineering, Texas A&M University, 1980 -
Professor (joint appointment), Agricultural Engineering, Texas A&M University, 1982-1994
Associate Professor, Industrial Engineering, Texas A&M University, 1974 - 1980
Assistant Professor, Industrial Engineering, Texas A&M University, 1970 -1974

Consulting:
Hughes Tool Company, 1972
United States Air Force, Manpower Analysis, 1981
Metrica, 1990-93, 1996
Sematech, 1993-1994
Texas Instruments, 1996

Principal Publications:

Books:

Articles: (59 total)

Professional Societies: IIE (previously 40 years membership INFORMS)

Awards & Honors:

Outstanding Teacher-Student ORSA Chapter, 1972
Texas A&M University Distinguished Faculty Achievement Award for Research, 1980
TEES Research Fellow: 1983-84, 1984-85, Senior Fellow 1985
Halliburton Professorship Award, 1983-84
TAES Award in Excellence – Team Research, 1988
Sematech Inventor Recognition Award for Software Development, 1991
IIE Transactions Best Paper of the Year Award, 1998
IIE Transactions Best Publication of the Year Award, 1998
Industrial Engineering Department Most Valuable Professor Award: 1999, 2003, 2004
Eastern Oklahoma State College Hall of Fame, 2000
Albert G. Holzman Distinguished Educator Award IIE – May 2006
Association of Former Students Teaching Award, Engineering College – Dec. 2007
Texas A&M University Distinguished Faculty Achievement Award for Teaching, 2010
Institute of Industrial Engineers - Fellow Award – 2010
Charles Crawford Distinguished Service Award – College of Engineering, 2011

Professional Service:

University Academic Council, 1979-81
College of Engineering Graduate Instruction Committee, 1974-77
College of Engineering Faculty Advisory Committee, 1996-98
Industrial Engineering Graduate Committee: 1978-81, 1985-86
Chair, Industrial Engineering Promotion and Tenure Committee: 1985-86, 1992-1995
Chair, Industrial Engineering Faculty Search Committee: 1994-95, 1997
Chair, Industrial Engineering Scholarships Committee, 1997-98
Chair, Industrial Engineering Undergraduate Committee, 1999-01
Chair, Industrial Engineering Graduate Committee, 2002-03
Director of Industrial Engineering Graduate Programs (May 2003-Sept. 2012)
Program Chair for the 6th Annual Industrial Engineering Research Conference, held May 17-18, 1997, Fontainebleau Hilton, Miami Beach, Florida
Yu Ding
Professor and Director of Graduate Programs

Ph.D., Mechanical Engineering, University of Michigan, 2001
M.S., Mechanical Engineering, Pennsylvania State University, 1998
M.S., Precision Instruments, Tsinghua University, Beijing, China, 1996
B.S., Precision Engineering, University of Science and Technology of China, 1993

Years of Service at Texas A&M: 12

Professional Experience:
Professor, Industrial & Systems Engineering and Electrical & Computer Engineering, Texas A&M University, 2012 - present
Associate Professor, Industrial & Systems Engineering, Texas A&M University, 2007-2012
Assistant Professor, Industrial & Systems Engineering, Texas A&M University, 2001-2007

Principal Publications:

Professional Societies: IIE, IEEE, INFORMS, ASME

Awards & Honors:
Charles H. Barclay, Jr.’45 Faculty Fellow, College of Engineering, Texas A&M, April 2013.
Centerpoint Energy Career Development Professorship, Industrial and Systems Engineering Department, Texas A&M University, Jan 2010 – Dec 2012.

Brockett Professorship Award, College of Engineering, Texas A&M University, April 2009.

Donna and Jim Furber ’64 Faculty Fellow, Industrial and Systems Engineering Department, Texas A&M University, April 2007.

Best Paper Award, IIE Transactions on Quality and Reliability Engineering, 2006

Montague Center for Teaching Excellence Scholar, Texas A&M University, 2005

CAREER Award, National Science Foundation, 2004

ASME Best Paper Award, ASME Manufacturing Engineering Division, 2000

**Professional Service:**

Director, Graduate Programs, Industrial & Systems Engineering, Texas A&M University

Member, Program Committee, IIE Annual Research Conference, 2005

Mini-Track Organizer, INFORMS Annual Meeting, 2004 & 2005

Chair, INFORMS Section on Quality, Statistics, and Reliability, 2008

Department Editor, *IIE Transactions on Quality and Reliability Engineering, 2005 - present*

Associate Editor, *IEEE Transactions on Automation Science and Engineering, 2006-2009*

*Guest Editor, Technometrics, 2013-present.*
Alaa Elwany  
Assistant Professor

Years of Service at Texas A&M: 1

EMPLOYMENT

Texas A&M University – College Station, TX  
Assistant Professor – Department of Industrial and Systems Engineering  
Aug 2013 - Present

General Motors R&D – Warren, MI  
Researcher – Manufacturing Systems Research Laboratory  
Feb 2011 – Aug 2013

Eindhoven University of Technology – Eindhoven, the Netherlands  
Assistant Professor – Department of Industrial Engineering and Innovation Sciences  
Aug 2009 – Feb 2011

EDUCATION

Ph.D. in Industrial & Systems Engineering  
Georgia Institute of Technology, Atlanta, GA  
Jun 2009

M.Sc. in Industrial Engineering  
Alexandria University, Alexandria, Egypt  
Sep 2004

B.Sc. in Production Engineering  
Alexandria University, Alexandria, Egypt  
Sep 2002

PROFESSIONAL EXPERIENCE

General Motors R&D – Researcher  
Feb 2011 – Present

- Led technical projects in the manufacturing systems research laboratory to improve the efficiency and sustainability of GM’s manufacturing operations.
- Developed models and algorithms to optimize the replacement of material handling equipment.
- Built user-friendly decision support interface for implementation in plants. Achieved $100K annual savings for one pilot plant in North America. Tool scheduled for global roll out in 2014 (150 plants).
- Filed a patent to optimize the energy use in GM’s casting foundries. Developed mathematical programming models to optimize energy usage with the objective of saving cost and decreasing CO2 emissions.

Eindhoven University of Technology, Netherlands – Assistant Professor  
Aug 2009 – Feb 2011

- Taught graduate and undergraduate courses on the Modeling and Analysis of Manufacturing Systems, Operations Management, and Reliability Engineering.
- Nominated for best instructor in the faculty of engineering, Eindhoven University.
- Won highest research honor award for junior faculty member (Innovation Research Scheme) from the Netherlands Institute of Scientific Research (www.nwo.nl)

Georgia Institute of Technology – Graduate Research & Teaching Assistant  
Jan 2005 – Jun 2009

- Conducted research in applied operations research and statistics.
- Assisted in establishing the Prognostic Systems Research Laboratory. Built experimental setup to test degrading rolling elements bearings. Developed models and algorithms to predict remaining useful life and determine optimal replacement intervals. Deployed user-friendly interface on in Labview. Achieved up to 96% accuracy of failure prediction.
- Assisted in teaching undergraduate courses on probability and statistics and engineering economy.

SERVICE AND ORGANIZATIONAL EXPERIENCE

Institute of Industrial Engineers Young Professionals (IIE YP)  
Jan 2013 – Present

- Responsible for organizing outreach of IIE YP in regional and national conferences

IIE Annual Applied Solutions Conference – Track Chair  
May 2012

- Responsible for inviting, refereeing, and coordinating sessions within the track (one out of eight other tracks in the Applied Solutions Conference – Institute of Industrial Engineers)
Eindhoven University of Technology – Workshop Organizer
-Organizer of workshop on optimal control in stochastic systems.

INFORMS Annual Meeting – Track Chair  Oct 2006 – Oct 2011
-Organized 5 sessions on Prognostics and Health Management in 4 consecutive meetings

Peer Reviewer for Academic Journals
-Reviewed for the journals IIE Transactions, IEEE Transactions, Operations Research, and Computers and Industrial Engineering

SCHOLARLY ACCOMPLISHMENTS
I. Selected Refereed Publications


II. Research Grants
1. Title: Sensor-driven Prognostic Models for Improved Failure Prediction and Service Logistics.
   Funding Organization: The Netherlands Organisation for Scientific Research (www.nwo.nl)
   Amount: € 229, 000

2. Title: General Maintenance Policies for Mobile Equipment
   Funding Organization: Natural Sciences and Engineering Research Council of Canada (NSERC)
   Amount: $ 25,000

3. Title: Proactive Service Logistics for Advanced Capital Goods (Co-PI).
   Funding Organization: Dutch Institute for Advanced Logistics (www.Dinalog.nl)
   Amount: € 2,300,000 (Share 30% = € 800,000)

III. Intellectual Property (IP)

HONORS AND AWARDS
VENI Laureate – Dec 2010
Highest honor for junior research faculty from the Netherlands Organisation for Scientific Research (Corresponds to the USA NSF CAREER Award).


Article in the IE Magazine (Vol. 40, No. 7)  Jul 2008
highlighting my research on spare parts inventory

Finalist, QSR Best Student Paper Competition, Nov 2007 INFORMS Annual Meeting, Seattle, WA
Award for outstanding undergraduate student – 1997-2001

Production Engineering Department – Alexandria – Egypt
Richard M. Feldman  
Senior Professor and Director of Undergraduate Program

Years of Service at Texas A&M: 38

Phone: (979) 845-5585  
E-mail: richf@tamu.edu

Professional Interests:  
Applied Probability and Simulation  
Queueing Network Analysis  
Mathematical Modeling and Software Systems

EDUCATION
Ph.D.  Industrial Engineering, Northwestern University, 1975
M.S.  Industrial and Systems Engineering, Ohio University, 1970
M.S.  Mathematics, Michigan State University, 1967
B.A.  Mathematics, Hope College, 1966

EXPERIENCE: Educational
Senior Professor of Industrial Engineering and Professor Emeritus, 9/2011-present
Director, Undergraduate Programs, Industrial Engineering, Texas A&M University, 1/2011-present
Professor of Industrial Engineering, Texas A&M University, 9/1985-8/2011
Director, Graduate Programs, Industrial Engineering, Texas A&M University, 6/1990-5/2003
Associate Professor of Industrial Engineering, Texas A&M University, 9/1980-8/1985
Assistant Professor of Industrial Engineering, Texas A&M University, 8/1975-8/1980
Instructor of Industrial Engineering, Ohio University, 9/1970-6/1972

EXPERIENCE: Industrial
Consultant:  Factory Physics Inc, Shell Chemical Co, Houston Consulting Group, Resources Research Corp, ALCOA, Stress Dynamics Inc., and Wright Killen Inc.
Industrial Engineering (half-time) Michael Reese Medical Center, 1974-75
Operations Research Analyst, Goodyear Atomic Corporation, 1967-70
Quality Control Analyst (summer employment), Dow Chemical Co., 1966

HONORS AND AWARDS
Most Valuable Professor Award by the IE Student Honor Society, 4/11, 4/00, 4/98, 4/97, 4/92, 4/92
Tenneco Award for Teaching Excellence, Engineering College, 4/10, 9/96
B. P. Amoco Teaching Excellence Award, Engineering College, 9/00.
Alcoa Foundation Research Award for Manufacturing Modeling, 6/96.
Association of Former Students Distinguished Teaching Award, University Level, 5/90.
General Dynamics Award for Teaching Excellence, Engineering College, 10/88.
Halliburton Professorship for the 1987-88 academic year, 9/87.
Association of Former Students Teaching Award, Engineering College, 9/84.

PROFESSIONAL REGISTRATION
Registered Professional Engineer in the state of Texas (#42208)

PUBLICATIONS: Books


**PUBLICATIONS: Recent Refereed Journal Articles**


**RECENT FUNDED RESEARCH PROJECTS**


Applied Silvicultural Assessment of Southern Pine Beetle in Southern Pine Stands West of the Mississippi. Collaborating Investigator (Principal Investigator: Robert Coulson). Funded by the USDA Forest Service through TAES for 9/05–10/08.

Developing a User Friendly GBFSM In Support of Coastal Fisheries Management, Second Year. Co-Principal Investigator. Funded by the Texas Parks and Wildlife Department through TAES for 12/02–12/04.
Ph.D., Industrial and Operations Engineering, University of Michigan, 2010
M.S., Industrial and Operations Engineering, University of Michigan, 2006
B.S., Industrial Engineering, University of Iowa, 2003

Years of Service at Texas A&M: 3

Professional Experience:
Assistant Professor, Industrial Engineering, Texas A&M University, 2011-

Graduate Student Research Assistant and Instructor, Industrial and Operations Engineering, University of Michigan, 2004 - 2010

Principal Publications:


Professional Societies: Human Factors and Ergonomics Society
Awards & Honors:
Runner up, 2011 Human Factors Prize (annual best paper award for the Journal Human Factors) 2011
Distinguished Achievement Award, University of Michigan College of Engineering 2010
WorldHaptics '09 Award for Best Paper in Haptics Science 2009
National Science Foundation (NSF) Graduate Research Fellowship 2005 – 2008
HFES Alphonse Chapanis Best Student Paper Award 2007

Professional Service:
Track Chair, Human Factors and Ergonomics Track, ISERC 2014
Member, Program Committee, HFES Symposium on Human Factors and Ergonomics in Healthcare, 2012, 2013, 2014
Guest Editor, Health Environments Research and Design Journal, special issue on Human Factors and Ergonomics, 2013
Student representative, HFES Education Technical Group Board, 2007 – 2009
Proposal Reviewer, National Science Foundation

Reviewer:
Human Factors
Presence
IEEE Transactions on Intelligent Transportation Systems
IEEE Transactions on Systems, Man, and Cybernetics, Part A
Applied Ergonomics
Journal of Laboratory Automation
Ergonomics In Design
Human Factors and Ergonomics Society Annual Meeting
Human Factors and Ergonomics Society Health Care Symposium
WorldHaptics (IEEE Robotics and Automation Society
Natarajan Gautam  
Associate Professor

Ph.D., Operations Research, University of North Carolina at Chapel Hill, 1997  
M.S., Operations Research, University of North Carolina at Chapel Hill, 1995  
B.S., Mechanical Engineering, Indian Institute of Technology-Madras, 1993

**Years of Service at Texas A&M: 8**

**Professional Experience:**

Associate Professor, Industrial & Systems Engineering, Texas A&M University, 2005-

Associate Professor, Industrial Engineering, Pennsylvania State University, 2003-2005

Assistant Professor, Industrial Engineering, Pennsylvania State University, 1997-2003

Research Assistant, Operations Research, University of North Carolina at Chapel Hill, 1994-1997

Instructor, Mathematics, University of North Carolina at Chapel Hill, 1993-1994

**Principal Publications:**


**Professional Societies:** IEEE, IIE, INFORMS  
**Awards & Honors:**
Jill and Charles F. Milstead ’60 Faculty Fellow (endowed fellowship appointment), May 2013 – April 2015.

Texas A&M-IIE Professor of the Year Award (joint-winner), April 2013.

Texas A&M College of Engineering: Tenneco Meritorious Teaching Award, April 2012.

Texas A&M IIE Advisor Appreciation Award, April 2012.

Outstanding Young Industrial Engineer Award (education category), by IIE, May 2006.


Professional Service:

Associate Editor, *Omega*, 2010 – present.
President-Elect, President and Past-President, IIE’s CIS division Board, 2008-2011.
Regional Director and Treasurer, Omega Rho, 2003-present.
Member-of-council for INFORMS Telecommunication Section, 2006-2010.
INFORMS Annual Conference Organizing Committee, Invited Cluster Co-chair, Austin TX, November 2010.
IERC Conference Organizing Committee, IIE Annual Conference, Cancun, Mexico, June 2010.
Session Chair for several INFORMS and IIE conferences, 1997-2013.

Reviewer (selected list):
Andrew L. Johnson  
Associate Professor

Professional Preparation
Virginia Polytechnic Institute and State University (Magna Cum Laude)  B.S.  2001
Tohoku University, Sendai, Japan  Visiting Student  1999-00
Georgia Institute of Technology  M.S.  2002
Georgia Institute of Technology  Ph.D.  2006

Years of Service at Texas A&M: 7

Appointments
- Associate Professor, Industrial and Systems Engineering, Texas A&M University, 2012-present.
- Co-Director, Laboratory for Energy-Sustainable Operations at Texas A&M University, 2011-present.
- Visiting Professor, School of Business, Aalto University, 2013-2014.
- Assistant Professor, Department of Industrial and Systems Engineering, Texas A&M University, 2006-2012.
- Research Fellow, National Graduate Institute for Policy Studies, Tokyo, Japan, Spring 2011
- Research Fellow, Department of Information Physics and Sciences, Osaka University, Summer 2007, Summer 2008, Summer 2009, Winter 2012.
- Industrial Engineer, Rock Drill Division, Ingersoll-Rand, Yokohama Japan, 2000
- Industrial Engineer, Rock Drill Division, Ingersoll-Rand, Roanoke Virginia, 1998 & 1999

Selected Publications


Selected Funded Projects

2013 - 2017 Sustainable Transition of European Energy Markets – STEEM; Researcher; Aalto Energy Research Initiative

2013 - 2016 Data Envelopment Analysis for Forecasting; Co-PI; Japan Society for the Promotion of Science


2010- 2013 Network Data Envelopment Analysis; Co-PI; Japan Society for the Promotion of Science.

2009- 2013 NSF-EAGER: Engineering Incentives for Health Care Systems; PI; National Science Foundation.

2009 Invitation Fellowship Program for Research in Japan; PI; Japan Society for the Promotion of Science

2007 Lean Warehouse Management; Co-PI; Wilson Supply.

2006-2007 Warehouse Performance Self-Assessment and Benchmarking; PI; The Book Industry Study Group, Inc.

Ph.D. Students Advised


Chia-Yen Lee – 2012- advisor - Dissertation: Demand Effects in Productivity and Efficiency Analysis. Job Placement: Assistant Professor at the Institute of Manufacturing Information and Systems, National Cheng Kung University, Taiwan.

Brandon Pope - 2011 -co-advised - Dissertation: Engineering incentives in distributed systems with healthcare applications. Job Placement: Assistant Research Scientist in the Regenstrief Center for Healthcare Engineering at Purdue University


Awards and Recognitions

2013 3rd Place, Material Handling Student Design Competition – Advisor

2011 Omega – Best Reviewer Award

2009 Honorable Mention, Material Handling Student Design Competition – Advisor

2007-2008 Informs TAMU Faculty Appreciation Award

1996 Eagle Scout
Kiavash Kianfar
Associate Professor

Sharif U. of Technology, Iran Industrial Engineering M.S. (highest honor) 1998 - 2000

Years of Service at Texas A&M: 6

Professional Experience
Associate Professor, Dept. of Industrial and Sys. Eng., Texas A&M U. 2012 - Present
Assistant Professor, Dept. of Industrial and Sys. Eng., Texas A&M U. 2007 - 2012
Teaching Assistant & Instructor, Dept. of Ind. and Sys. Eng., North Carolina State U. 2003 - 04
Senior Research Staff, System Productivity Center, Sharif U. of Tech., Iran 2001 - 2002
Teaching Instructor, Dept. of Industrial Eng., Sharif U. of Tech., Iran 1998 - 2003

Principal Publication


**Professional Societies:** INFORMS, MOS, IIE, SIAM

**Awards and Honors**
IIE Pritsker Doctoral Dissertation Award, First Place, May 2008
For dissertation: “Generalized Mixed Integer Rounding Valid Inequalities”
INFORMS George Nicholson Paper Award, Honorable Mention (one of 6 finalists), Nov. 2006
For the paper “Generalized Mixed Integer Rounding Valid Inequalities”
Invited Speaker at Mixed Integer Programming (MIP) 2012 Workshop, UC-Davis, 2012
Only 23 speakers are invited.
Invited Speaker at Mixed Integer Programming (MIP) 2009 Workshop, UC-Berkeley, 2009
Only 25 speakers were invited.
Who is Who in America, 2011
Nominated for (and attended) INFORMS Future Academician Colloquium, Nov. 2006
Phi Kappa Phi Honor Society, Member, since Mar. 2005
Alpha Pi Mu (Industrial Engineering Honor Society), Member, since Apr. 2006

**Professional Service**
Proposal Review Panelist: National Science Foundation
Session Chair: INFORMS Annual Meeting, Minneapolis, MN, Oct. 2013
Session Chair: INFORMS Annual Meeting, Charlotte, NC, Nov. 2011
Session Chair: INFORMS Annual Meeting, Austin, TX, Nov. 2010
Session Chair: INFORMS Southwest Regional Conference, College Station, TX, Apr. 2008
Associate Editor: Scientia Iranica Transactions on Industrial Engineering, 2008 - Present

**Journal Paper Reviewer:**
- Mathematical Programming
- Mathematics of Operations Research
- Operations Research
- INFORMS Journal on Computing
- Discrete Optimization
- Annals of Operations Research
- Optimization Letters
- Journal of Industrial and Systems Engineering
- Scientia Iranica
Georgia-Ann Klutke
Professor

Ph.D., Industrial Engineering and Operations Research, Virginia Polytechnic Institute and State University, 1986
M.S., Operations Research, Wayne State University, 1979
M.S., Biostatistics, University of Michigan, 1977
B.S. (with honors), Mathematics, University of Michigan, 1975

Years of Service at Texas A&M: 18

Professional Experience:
Associate, Full Professor, Industrial and Systems Engineering, Texas A&M University, 1995-present.
Assistant, Associate Professor, Mechanical Engineering, University of Texas at Austin, 1989-1995.
Assistant Professor, Industrial Engineering and Operations Research, University of Massachusetts, 1986-1989.

Principal Recent Publications:


External Funding: PI, PD, or co-PI on 6 grants from National Science Foundation, 1 grant from U.S. Department of Education, 1 grant from National Aeronautic and Space Administration, 1 grant from state of Texas, 3 grants from industrial sponsors

Professional Societies: IIE, ASEE, INFORMS
Awards & Honors:
Fellow, Institute of Industrial Engineers, 2005.
Halliburton Fellow, Look College of Engineering, Texas A&M University, 2008.
3M Fellow, Look College of Engineering, Texas A&M University, 2003.
Gordon Research Conference: Theoretical Foundations of Product Design
and Manufacturability, 1998.
General Dynamics Endowed Faculty Fellowship, The University of Texas at Austin, 1993-1995.
Engineering Foundation Award, The University of Texas at Austin, 1992.
Halliburton Foundation Award of Excellence, The University of Texas at Austin, 1992.

National and International Professional Service:

U.S. National Science Foundation: Advisory Committee, Directorate for Engineering, 1998-
2002, Member, Committee of Visitors, Division of Civil, Mechanical and Manufacturing
Innovation, 2009, Member, Committee of Visitors, Division of Design, Manufacture and
Industrial Innovation, 2006, Chair, Committee of Visitors, Division of Design, Manufacture, and
Industrial Innovation, 2000, Blue Ribbon Review Panel for Engineering Research Centers,

U.S. Department of Education: Review Panel, Graduate Assistantships in Areas of National

Korean Ministry of Education, Science and Technology, Review Panel, World Class

Editorial Boards:
Consulting Editor, Springer Series in Mechanical Engineering, 1995-present
Associate Editor, Operations Research, 1990-95
Associate Editor, Operations Research Letters, 1994-99
Department Editor, IIE Transactions on Operations Engineering, 2004-2007

External Review Committees:
University of Arizona, Academic Program Review, Department of Systems and Industrial
Engineering, 2000
Greater Kelly Development Corporation, Expert Committee to Review Strategic Plan
for Kelly AFB Conversion to Civilian Management, 1999

Numerous service activities with Institute of Industrial Engineers (IIE) and Operations Research
Society of America (ORSA), including program chair of two national conferences.
César O. Malavé, P.E.
Sugar and Mike Barnes Department Head Chair, Professor and Department Head

Ph.D., Industrial Engineering, University of South Florida, 1987
M.S., Operations Research, Georgia Institute of Technology, 1983
B.S., Chemical Engineering, Georgia Institute of Technology, 1981

Years of Service at Texas A&M: 26

Department Head and Sugar and Mike Barnes Department Head Chair, Industrial and Systems Engineering, Texas A&M University, 2012-present
Interim Department Head, Industrial and Systems Engineering, Texas A&M University, 2011-2012
Associate Agency Director, TEES, 2010-2012
Associate Dean of Engineering, Dwight Look College of Engineering, Texas A&M University, 2007-2012
Associate Dean for Recruitment and International Programs, Dwight Look College of Engineering, Texas A&M University, 2007-2009
Assistant Dean for International Programs, Dwight Look College of Engineering, Texas A&M University, 2003-2007
Professor, Industrial Engineering, Texas A&M University, 2002-2003
Associate Professor, Industrial Engineering, Texas A&M University, 1993-2002
Interim Project Director, The Foundations Coalition, Texas Engineering Experiment Station (TEES), 1999
Faculty Intern Electronic Assembly Plant, Westinghouse Corporation, 1991
Assistant Professor, Industrial Engineering, Texas A&M University, 1987-1993
Instructor, Industrial Engineering, University of South Florida, 1983-1987

Principal Publications:

Fournier-Bonilla, Sheila D., Watson, Karan L., Malave, Cesar O. and Froyd, Jeffrey, “Managing

**Professional Societies:** IE, ASEE, NCEES

**Awards & Honors:**

Faculty of the Future Fellow, General Electric Foundation, 1989
Outstanding Service and Dedication Award, Society of Hispanic Professional Engineers, Student Chapter, 1995 & 1999
Excellence in Engineering Teaching Award, Lockheed Martin Tactical Aircraft Systems, 1995
Dedicated Service Award, Engineering Program Administration, 1996
Outstanding Service as Judge – Texas Best, Texas Instruments and TAMU, 1998 & 1999

Diploma, Instituto de Estudios Avanzados Suger Montano, 1999
Teaching Excellence Award-College Level, The Association of Former Students, Texas A&M University, 2002
Phi Beta Delta International Society, 2003
Alcoa Faculty Fellow, Texas A&M Engineering Program, 2005

**Professional Service:**

Review Panel Member, Course, Curriculum, and Laboratory Improvement Program, National Science Foundation, 1999
Industrial Engineering Visitor, Pre-ABET Visit, NJIT, 2000
Reviewer, International Programs Division, National Science Foundation, 2001
Reviewer, Division of Design and Manufacturing, National Science Foundation, 2001
Member, Inclusive Learning Communities Advisory Committee, Dwight Look College of Engineering, 1989-present
Member, Illegal Discrimination Panel, Texas A&M University, 1993-present
Faculty Advisor, Society of Hispanic Professional Engineers, 1994-present
Advisory Council, Center for Mathematics and Science Education, College of Science, College of Engineering Representative, 1995-present
Faculty Senate, College of Engineering Representative, 1996-present
Academic Affairs Committee, Faculty Senate, Member, 1996-1997; Vice-Chair, 1997-1998; Chair 1998-1999
Puerto Rican Students Association, Faculty Advisor, 1988-present
Student Retention Committee, Texas A&M University, Engineering Member, 1999
Keynote Speaker, NSF Workshop for Recruitment and Retention of Minority Educators, 2003 & 2004
Cluster Chair, INFORMS Annual Meeting, 2003
Keynote Speaker, Congresso Brasileiro de Ensino/de Engenharia, 2002
Member, IE Group, National Council of Examiners for Engineering and Surveying
Member, Engineering Field of Study Committee, Texas Higher Education Coordinating Board
Erick Moreno-Centeno  
Assistant Professor  

Ph.D., Industrial Eng. & Operations Research, University of California, Berkeley, 2010  
M.S., Computer Science, University of California, Berkeley, 2010  
M.S., Industrial Eng. & Operations Research, University of California, Berkeley, 2006  
B.S., Industrial Physics Engineering, ITESM-Monterrey México, 2002  

Years of Service at Texas A&M: 3  

Professional Experience  
Assistant Professor, Industrial & Systems Engineering, Texas A&M University, 2012-  
Visiting Assistant Professor, Industrial & Systems Eng., Texas A&M University, 2010-2012  
IT Consultant, DMR Consulting México, 2003-2004  
Research and Teaching Assistant, IEOR, University of California, Berkeley, 2007-2009  

Principal Publications (* Indicates my graduate students)  
Hochbaum D. S., E. Moreno-Centeno, “Country credit-risk rating aggregation via the separation-deviation model”, Optimization Methods and Software, 23(5) 2008, 741–762  
Hochbaum D. S., E. Moreno-Centeno, P. Yelland, R. A. Catena, “Rating customers according to their promptness to adopt new products”, Operations Research, 59(5) 2011, 1171–1183  
Professional Societies: INFORMS, IIE, ACM, ASEE, SMIO

Awards & Honors:

Professor of the Year Award, IIE Student Chapter, Texas A&M University, 2013
Montague - Center for Teaching Excellence Scholar, Texas A&M University, 2012
Katta G. Murty Best Paper Prize, IEOR Department, UC Berkeley, 2009
Graduate Student Instructor of the Year, IIE Student Chapter, UC Berkeley, 2008
Marshall-Oliver-Rosenberger Award, IEOR Department, UC Berkeley, 2007
Outstanding Graduate Student Instructor, Teaching Center, UC Berkeley, 2007

Professional Service:

Proposal Reviewer, National Science Foundation, 2013
Panel Organizer, INFORMS Annual Meeting, 2013
Session Chair, INFORMS Annual Meeting, 2013
Scientific Committee Member, 5th Latin-Ibero-American OR Workshop (TLAIO-V), 2013
Session Chair, Mexican OR Society Conference (CSMIO-I), 2012
Judge, INFROMS Decision Analysis Society Student Paper Competition, 2012
Scientific Committee Member, 1st Mexican OR Society Annual Conference (CSMIO-I), 2012
Session Chair, INFORMS Annual Meeting, 2008

Reviewer:
Operations Research
Management Science
Mathematics of Operations Research
SIAM Journal on Discrete Mathematics
Networks
IIE Transactions
Optimization Letters
Annals of Operations Research
Journal of Discrete Algorithms
Journal of Combinatorial Optimization
Journal of Global Optimization
Optimization Methods and Software
Conference Approx 2009
Conference ISERC 2012
International Journal of Management Science
International Journal of Computer Integrated Manufacturing
Professional Preparation

University of Arizona  Systems and Industrial Engineering  Ph.D.  2004
University of Arizona  Mining and Geological Engineering  M.S.  2000
University of Arizona  Mining Engineering  B.S.  1998

Years of Service at Texas A&M: 9

Professional Experience

2010 – Present:  Associate Professor, Industrial and Systems Engineering, TAMU
2012: Visiting Professor, Computer Science, University of Milan – Bicocca, Italy
2004 – 2010: Assistant Professor, Industrial and Systems Engineering, TAMU
2001 – 2004: Research Assistant, Systems and Industrial Engineering, University of Arizona
1999 – 2000: Research Assistant, Mining and Geological Engineering, University of Arizona

Principal publications

**Professional Memberships:** INFORMS, IIE, MPS, SCS, INCOSE

**Awards and Honors:**

2010 George Armistead, Jr. ’23 Faculty Fellow, TAMU

2010 Donna and Jim Furber ’64 Faculty Fellowship, TAMU

2007 Outstanding Professor Award, Alpha Pi Mu Student Chapter Society, TAMU

2007 Appointment to the INFORMS Young Researcher Connection.

2007 Marquis Who is Who in America, honored biographee, 61st Edition

**Professional Service**

*Vice Chair:* Stochastic Programming, INFORMS Optimization Society, 2008-2010

*Secretary:* INFORMS Minority Issues Forum, 2013-present

*Editorial Board:* Journal of Global Optimization

*Session Chair:*

INFORMS 2007-12;
IFORS 2011;
DEVS Symposium 2006
INFORMS International 2007, 2010

Technical Committee: DEVS Symposium, Spring Simulation Multiconference, 2006 – present

*Proposal Reviewer:*

National Science Foundation
Air Force Office of Scientific Research
Natural Sciences and Engineering Research Council of Canada

*Reviewer:*

Operations Research
Journal of Global Optimization
IIE Transactions
INFORMS Journal on Computing,
European Journal of Operational Research
Mathematical Programming
Computational Optimization and Applications
Annals of Operations Research
International Journal of Modeling and Simulation
Canadian Journal of Forest Research,
International Journal of Wildland Fire
Environmental Modeling and Software
Forest Science
EDUCATION
Ph.D.  Industrial Engineering, University of Texas at Arlington, August 1984.
M.S.  Industrial Engineering, Western Michigan University, August 1980.
B.S.  Economics, National University of Iran, January 1978.

Years of Service at Texas A&M: 3

PROFESSIONAL EXPERIENCE
Professor with Tenure, Department of Industrial and Systems Engineering, Texas A&M University, College Station (September 2013 – present)
Associate Dean for Academic Affairs and Professor of Mechanical Engineering, Texas A&M University – Qatar, (September 2010 - present)
Interim Chair, Mechanical Engineering Program, Texas A&M University – Qatar (May 2011 – June 2013)
Professor with Tenure, Department of Industrial Engineering, University of Houston (January 2001 – August 2012)
Chairman, Department of Industrial Engineering, University of Houston (January 2001 – August 2010)
Director, Executive Graduate Program in Industrial Engineering with concentration in Engineering Management (April 2009 – August 2010)
Director of Graduate Studies and Graduate Advisor, Department of Industrial Engineering, University of Houston (January 2003 – December 2005 and January 2008 – February 2010)
Director, Texas Manufacturing Assistance Center (TMAC) - Gulf Coast Region (March 2001 – September 2005)
Director, Houston Productivity Institute (November 2005 – August 2010)
Member of Executive Council, Texas Manufacturing Assistance Center, (March 2001 – September 2005)
Member of the Cullen College of Engineering Teaching Effectiveness Committee, University of Houston, (September 2007 – present)
Member of the Cullen College of Engineering Promotion and Tenure Committee, University of Houston, (January 2001 – present)
Member of the Cullen College of Engineering Distinguished Professors Screening Committee (The College and the University Chair Professorship Committee), University of Houston (January 2001-present)
Member of the Cullen College of Engineering Graduate Standards Committee, University of Houston, (September 2007 – present)
Chair of Cullen College of Engineering Staff Recognition Committee, initiated and developed guidelines for the college wide annual staff recognition, 2009.
Chair, Committee for Further Engaging the Cullen College of Engineering Alumni in Philanthropic and Development Activities (March 2009 – present).
Director, Manufacturing Research Group, University of Louisville (September 1993 – December 2000).
Professor (with tenure), Department of Industrial Engineering, University of Louisville (July1996-December2000)
Associate Professor (with tenure), Department of Industrial Engineering, University of Louisville (July 1990 - June 1996).
Acting Associate Director, Center for Computer-Aided Engineering, University of Louisville (January 1990 - December 1990).
Assistant Professor, Department of Industrial Engineering, University of Louisville (September 1986 - June 1990).
Elected Member of the Graduate Faculty, University of Louisville (November 1987).
Assistant Professor, Department of Industrial Engineering Technology, SUNY College of Technology,
State University of New York, Utica, New York (September 1984 - August 1986)

NON-ACADEMIC EXPERIENCE
Vice President, Integrated Technology Systems (an engineering consulting firm), 1992-2010

PROFESSIONAL REGISTRATION
Registered Professional Engineer in the state of Texas (Registration No. 68174)

PRINCIPAL PUBLICATIONS

CURRENT MEMBERSHIP IN PROFESSIONAL ORGANIZATION
- America Society for Engineering Education, member since 1986
- Institute of Industrial Engineers, member since 1978

HONORS AND AWARDS
- Outstanding Teaching Award, Department of Industrial Engineering, University of Houston (May 2007).
- UPS Excellence Award for Minority in Industrial Engineers, *Institute of Industrial Engineers* (IIE), 2006
- Fellow, *Institute of Industrial Engineers* (IIE), May 1997
- Recipient of the 1993 Wellington Award for outstanding contribution to the field of Engineering Economics. This award is presented annually by the *Institute of Industrial Engineers* (IIE)
- Recipient of the Award of Merit at the Institute’s Annual Conference on May 20, 1992, in recognition of outstanding activities and service to the Engineering Economy Division during 1991-1992

SERVICE ACTIVITIES
- Chair, IIE Fellows Selection Committee and IIE Council of Fellows (2012)
- Chair-Elect, IIE Council of Fellows (2011)
- Chair, 11th Annual IIE Doctoral Colloquium, May 19, 2012, Orlando, Florida
- Co-Chair, 10th Annual IIE Doctoral Colloquium, May 21, 2012, Reno, Nevada.
- Chair, College wide ABET Committee, Texas A&M University at Qatar, 2010 – present
- Member, CIEADH/IERC Industrial Engineering Research Conference Committee, 2009-2012
- Chair, CIEADH/IERC Industrial Engineering Research Conference Committee, 2010-2011
Donald R. Smith, P.E.
Associate Professor

Ph. D., Industrial Engineering, University of Arkansas, 1973
M. S., Industrial Engineering, University of Arkansas, 1968
B. S., Industrial Engineering, University of Arkansas, 1965

Years of Service at Texas A&M: 38

Professional Experience:
Associate Professor, Industrial Engineering, Texas A&M, 1982- present
Assistant Professor, Industrial Engineering, Texas A&M, 1975-1982
Assistant Professor, Breech School of Business, Drury College, 1970-75
Assistant Professor of Industrial Engineering, La. Tech University, 1969-70
Staff Engineer, Phillips Petroleum, Bartlesville, OK, 1965-66
Operations Research Analyst, Sun Oil Corporation, Tulsa, OK and Dallas, TX, 1968-69

Consulting:
American Funeral Supply-Springfield, MO, 1975
City Utilities-Springfield, MO, 1973-1974
Bakers Confectionery and Tobacco Union Local No. 163, Houston, TX, 1979-1980
Vocational Industries Center, Houston, TX, 1980
TEXCON Building Products, Inc., Houston, TX, 1982
J.C.Kinley Company, Houston, TX, 1982
Jerry Birdwell & Associates, Bryan, TX, 1983-1987
Osborne Engineering, Bryan, TX, 1986 - 1989
Associated Attorneys’ Title Agency, Inc., Bryan, TX, 1985
Dillon, Elmore, Lewis, and Smith, Bryan, TX, 1986-1990
Investors Mortgage Banc, Inc., Conroe, TX, 1986 - 1987
Smith, Elmore, College Station, TX, 1988- 1993
Richland-Chambers, Inc., Corsicana, TX, 1989 – 1991
Siemens Corporation, Houston, Texas, 2009
Shell Oil, Houston, Tx 2010

Principal Publications:


Awards & Honors:

Texas A&M University Association of Former Students Outstanding Teaching Award, 1988

Association of Former Students Teaching Award – College of Engineering, 2013-14
Halit Üster  
Associate Professor

Ph. D., Management Science/Systems, McMaster University  
M.A., Business Administration, Operations Management, Hacettepe University, Ankara, Turkey  
B. S., Mechanical Engineering, Middle East Technical University, Ankara, Turkey

Years of Service at Texas A&M: 13

Professional Experience
- 2008-Present  
  Associate Professor, Industrial and Systems Engineering, TAMU
- 2013 (03-08)  
  Visiting Associate Professor, Industrial Engineering, Koc University, Turkey
- 2009-2010  
  Visiting Eshbach Scholar, IEMS Department, Northwestern University
- 2002–2008  
  Assistant Professor, Industrial and Systems Engineering, TAMU
- 2000–2002  
  Visiting Assistant Professor, Information and Operations Management, TAMU
- 1999–2000  
  Visiting Assistant Professor, Industrial Engr, U of Alabama, Tuscaloosa, AL

Selected Publications

Professional Affiliations: INFORMS, IIE, ISA
Selected Awards and Honors

- Caterpillar Teaching Excellence Award, Dwight Look College of Engineering, Texas A&M University, 2011.
- Faculty Appreciation Award, Texas A&M INFORMS Student Chapter, 2004 and 2009.
- Outstanding Faculty Member, voted by the IIE Chapter at the U of Alabama, 1999-2000.

Selected Professional Service

- Member, Faculty Senate, Texas A&M University, 2013–2016.
- Member, Engineering Faculty Advisory Council (EFAC), College of Engineering, 2013–2014.
- Chair, ISEN Department Growth Committee, 2013-14.
- Chair, INFORMS New Faculty Colloquium, to be inaugurated at INFORMS Conference, 2014.
- Organizing Committee, ISEN Seminar Series in conjunction with ADVANCE Center, Fall 2012 and 2013.
- Associate Editor, IIE Transactions, 2005 – 2010.
- Chair, INFORMS Southwest Regional Conference, Texas A&M Univ, College Station, TX, April, 2008.
- Chair, UPS-SOLA Bi-Annual Dissertation Award Committee (SOLA: Section on Location Analysis), 2007.
- Cluster Co-Chair, sponsored by Telecommunications Section, INFORMS Conference, 2007 and 2008.
- Member, Organizing Committee of the New Faculty Colloquium at IERC, Orlando, FL, 2006.
- Founding Director, Logistics and Networked Systems Research Lab, ISEN Department, since 2004.
- Faculty Advisor, Texas A&M INFORMS Student Chapter, 2004 (inception)-2008 & 2011-2012.
Jose A. Vazquez, Jr.
Lecturer

Years of Service at Texas A&M: 11

Areas of Interest:

- Writing
- Communications
- Learning theories
- Leadership

Education

BA, Political Science, Texas A&M University, College Station, TX (1975)

MA, Literary Studies, University of Iowa, Iowa City, IA (1986)


Awards

Legion of Merit
Bronze Star

Publications

“The Style Manual,” USMA, West Point, NY

Edited numerous professional articles and dissertations

Employment and Experience

Academic

Teaching Assistant, University of Iowa Writing Center, Iowa City, IA

Assistant Professor, USMA, West Point, NY

Professor of Military Science, Texas A&M University, College Station, TX

Assistant Lecturer, Center for Academic Enhancement, Texas A&M University, College Station, TX

Adjunct Faculty, National Emergency Response and Rescue Center, Texas Engineering Extension Service

Lecturer and Director of the Industrial and Systems Engineering Writing Center, Texas A&M University, College Station, TX
Professional and Leadership

Commanding Officer, 293rd Military Police Company, Fort Meade, Maryland

Commanding Officer, Taegu Field Office, United States Army Criminal Investigation Command, Taegu, Korea

Executive Officer, 759th Military Police Battalion, Fort Carson, Colorado

Executive Officer, 42d Corps Support Group, Fort Carson, Colorado

Commanding Officer, 759th Military Police Battalion, Fort Carson, Colorado

Provost Marshal, Fort Carson, Colorado

Personal Assistant and Speechwriter to the Vice Chief of Staff, United States Army Headquarters, The Pentagon, Washington, D.C.

Chief, Plans and Policy, Office of the Deputy Under Secretary of the Army (International Affairs), The Pentagon, Washington, D.C.

Professor of Military Science and Department Head, Department of Military Science, Texas A&M University, College Station, Texas

Languages

Spanish

Other

Retired soldier (colonel) who served 27 years in the United States Army.
Martin A. Wortman
Professor

Ph. D., Operations Research, Virginia Polytechnic Institute and State University, 1988
Ph. D., Electrical Engineering, Virginia Polytechnic Institute and State University, 1982
M.S., Electrical Engineering, North Carolina State University, 1980
B. S., Electrical Engineering, North Carolina State University, 1977

Years of Service at Texas A&M: 25

Professional Experience:

Professor, Industrial Engineering, Texas A&M University, 1999-
Visiting Professor, Industrial and Operations Engineering, University of Michigan, 2005
Associate Professor, Industrial Engineering, Texas A&M University, 1992-1999
Visiting Associate Professor, Mechanical Engineering, University of Texas at Austin, 1994
Assistant Professor, Industrial Engineering, Texas A&M University, 1988-1992
Visiting Assistant Professor, Electrical Engineering, Virginia Polytechnic Institute and State University, 1986-1988
Assistant Professor, Electrical and Computer Engineering, Clemson University, 1982-1985

Principal Publications:


**Professional Societies:** IEEE, SIAM, INFORMS

**Awards & Honors:**

Sigma Xi  
Tau Beta Pi (Engineering Honor Society)  
Eta Kappa Nu (Electrical Engineering Honor Society)  
Texas Engineering Experiment Station Fellow  
Select Young Faculty – Texas Engineering Experiment Station  
Dow Chemical Fellow 1998-1999 – Texas Engineering Experiment Station  
Eta Kappa Nu Outstanding Teacher Award 1987 – Virginia Polytechnic Institute  
CP&L Fellowship for Graduate Study – North Carolina State University

**Professional Service:**

Department Editor, *IIE Transactions*, 2001-2006  
Department Editor, *IIE Transactions*, 1995-1996  
Associate Editor, *IEEE Transactions on Reliability*, 1990-1996  
Served on more than 25 NSF proposal review panels

**Research & Consulting:**

Principle Investigator on 13 NSF grants  
Principle Investigator on 9 Industrial Grants  
Consultant with numerous private & public companies, Department of Defense, and Office of the Secretary of Defense  
U.S. Clearance Classification: Secret
Justin Yates
Assistant Professor

Education:
GIS (2008) Geography, University at Buffalo, State University of New York
Advanced Certificate in Geographic Information Science administered by the National Center for Geographic Information and Analysis (NCGIA), Buffalo, NY
M.S. (2007) Industrial and Systems Engineering, University at Buffalo, State University of New York

Years of Service at Texas A&M: 5

Awards and Honors:
10/2013: INFORMS 2013 Moving Spirit Award
2/2013: Southeastern Conference (SEC) Visiting Faculty Travel Grant Award
9/2012: Faculty Grand Challenge Champion: AggiE Challenge, Texas A&M University
4/2012: Awarded: INFORMS TAMU Student Chapter Faculty Appreciation Award
4/2010: Awarded: Texas A&M University Alpha Pi Mu Outstanding Professor Award
3/2009: Awarded: Big 12 Faculty Fellowship, Texas A&M University
4/2008: Honorable Mention in the April 2008 University at Buffalo engineering graduate student poster competition
5/2007: Awarded 2nd Place in the 2007 IIE Doctoral Colloquium Poster Competition (36 total participants by invitation only).
4/2003: Inducted: Kappa Mu Epsilon, Mathematics Honor Society
*Requirements include additional core coursework in GIScience and the incorporation of GIScience in the dissertation topic. Emphasis placed on multidisciplinary research and collaboration.

Professional Appointments:
8/2008 – present: Assistant Professor, Texas A&M University
5/2012 - 7/2012: Summer Faculty Fellow, Air Force Research Lab (Rome, NY)
11/2007 – 1/2008: Visiting Scholar, Fukuoka University, Fukuoka, Japan

Publications (Selected):
Grants and Funding:


Deputy Assistant Secretary of Defense (DASD) on Nuclear Matters: “Countering Nuclear Threats.” January 1st, 2011 - present (on-going project). coPIs (Texas A&M University): David Boyle (NE), Jasen Castillo (GB), William Charlton (NE), David Ford (GB), Craig Marianno, (NE), Paul Nelson (NE), Justin Yates (ISEN). $2,080,250 (ISEN, Texas A&M University: $55,067 - annually) (ISEN) - Industrial and Systems Engineering; (NE) - Nuclear Engineering; (GB) - George Bush School of Government

Texas A&M University, College Station, TX

National Science Foundation RAPID: “Collaborative Research: Identification of key dynamics for optimal distribution and sustainable partnership in Haitian Disaster Recovery.” Proposal #: 7011855, May 1st, 2010 - April 30th, 2011. coPIs: Justin Yates (Texas A&M University) and Jun Zhuang (University at Buffalo), Infrastructure Management and Extreme Events (NSF IMEE). $40,000 (Texas A&M University: $27,303)

Courses Taught:

ISEN 303: Engineering Economy {Fall 2008, Spring 2009, Fall 2013}
ISEN 459: Capstone Senior Design {Fall 2009 - Spring 2012}
ISEN 485: Directed Studies {as needed}
ENGR 289/489: Special Topics in Engineering {Fall 2012 - Fall 2013}
ISEN 601: Location Logistics of Industrial Facilities {Spring 2010, Fall 2012}
ISEN 685: Directed Studies {as needed}
ISEN 689: Special Topics in Spatial Optimization {Spring 2012, Spring 2013}
ISEN 692: Professional Studies {as needed}

Teaching - Average Evaluation by Course (maximum 5.0):

Fall 2008: 4.47 (ISEN 303) Spring 2009: 4.16 (ISEN 303)
Fall 2009: 4.51 (ISEN 459) Spring 2010: 4.36 (ISEN 459), 4.57 (ISEN 601)
Fall 2010: 3.70 (ISEN 459) Spring 2011: 4.42 (ISEN 459)
Fall 2011: 4.31 (ISEN 459) Spring 2012: 4.51 (ISEN 459), 4.64 (ISEN 689)
Fall 2012: 4.60 (ISEN 601) Spring 2013: 4.83 (ISEN 689)
Fall 2013: TBD (ISEN 303)
Appendix D

Industrial and Systems Engineering Graduate Course Descriptions
601. Location Logistics of Industrial Facilities. (3-0). Credit 3. Selection of the optimal locations of industrial plants and distribution centers through analytical modeling of the costs of inventory storage, transportation, utilities, labor supply and other cost components. **Prerequisites:** ISEN 620.

602. Applications of Random Processes. (3-0). Credit 3. Introduction to probability and random processes as a basis for studying topics in industrial engineering and operations research. **Prerequisites:** ISEN 609; STAT 212 or 601.

603. Advanced Logistics. (3-0). Credit 3. Topics in logistics including measures of logistical systems performance, facilities location allocation, production/distribution system design, transportation network design, vehicle routing; emphasis on mathematical modeling based on large scale integer programs and solution approaches for general network design problems. **Prerequisites:** ISEN 601, 622, 623, 668 or approval of instructor.

604. Competing on Information Flows in Supply Chains. (3-0). Credit 3. Review, evaluate, and contribute to the existing knowledge base regarding the management of information flows from automatic identification systems such as RFID. **Prerequisites:** ISEN 615 and PhD students or Masters students with a thesis degree plan or approval of instructor.

605. Material Handling Systems. (3-0). Credit 3. Analysis and design of integrated material handling systems; automatic storage and retrieval of unit loads, and identifying and establishing boundary conditions on key parameters required to specify the desired system required for equipment vendors to design appropriate hardware. **Prerequisites:** ISEN 420; ISEN 416

608. Industrial Case Analysis. (3-0). Credit 3. Practice in applications of principles to the solution of actual case problems involving broad management decisions. **Prerequisite:** Approval of instructor.

609. Probability for Engineering Decisions. (3-0). Credit 3. Introduction to probability and stochastic processes for characterization of uncertainty in engineering decisions. **Prerequisite:** Approval of instructor.

611. Foundations of Technology Evaluation and Assessment. (3-0). Credit 3. Quantifying gambles arising in engineering activities associated with the design, deployment, and operations of technology; analytical foundations of technology evaluation and assessment from an engineering perspective; focus on examination of probability models supporting quantification of value and risk. **Prerequisites:** ISEN 609 or approval of instructor.

612. Design by Reliability. (3-0). Credit 3. Quantitative reliability analysis in
engineering design. Reliability methods applicable to risk based design, component reliability and degradation, static and dynamic system reliability modeling and analysis, life testing, stress/strength analysis, and fault tree analysis. **Prerequisites:** ISEN 609; STAT 414.

613. Engineering Data Analysis. (3-0). Credit 3. Selected topics in probability and data analysis for quality in engineering problems; measurement principles, data collection and data analysis to solve quality engineering problems. Introduction to courses in the assurance sciences-reliability, maintainability, quality control and robust design

614. Advanced Quality Control. (3-0). Credit 3. Advanced methods applied to quality control and anomaly detection; classical treatments and recent developments in statistical process control; evaluation, design and maintenance of quality control programs; focus on monitoring and root cause identification. **Prerequisite:** STAT 212 or 601.

615. Production and Inventory Control. (3-0). Credit 3. Model development for inventory management and for production planning; production control models for line balancing, lot sizing, dispatching, scheduling, releasing, kitting, MRP and just-in-time with treatment of flexible manufacturing and assembly. **Prerequisites:** ISEN 620; ISEN 609.

616. Design and Analysis of Industrial Experiments. (3-0). Credit 3. Fundamental theory, concepts and procedures required for industrial experimental design, statistical data analysis, and model building, with emphasis on engineering formulations and applications. One-factor experiments with and without restrictions on randomization, treatment comparison procedures, Latin and other squares, factorial experiments, full and fractional two-level factorial experiments, blocking in factorial designs, response surface methodologies and introduction to Taguchi methods. **Prerequisite:** STAT 212 or 601.

617. Quantitative Models for Supply Chain Coordination. (3-0). Credit 3. Concepts, complexities, and models pertaining to supply chain management and relate these to recent practical initiatives; includes channel coordination models, supply chain contracting, and vendor-managed, inventory models. **Prerequisites:** ISEN 615, 623, and 609 or STAT 615 or approval of instructor

618. Stochastic Processes in the Assurance Sciences. (3-0). Credit 3. Stochastic processes necessary to deal with advanced problems in reliability, maintainability and other related areas. **Prerequisite:** ISEN 602.

619. Analysis and Prediction. (3-0). Credit 3. Data-mining methods and data-driven models; statistical model building and parameter estimation for Markov processes;
sampling of dynamic systems with random disturbances; on-line identification algorithms; design of time-series control charts for process monitoring; multivariate analysis; applications using real data. **Prerequisite:** ISEN 609.

**620. Survey of Optimization (3-0). Credit 3.** Theory and numerical methods for deterministic linear and nonlinear optimization; topics include linear programming, unconstrained-nonlinear optimization, constrained nonlinear optimization, Lagrange and K-K-T conditions, and numerical algorithms. **Prerequisite:** MATH 304 or MATH 311.

**621. Heuristic Optimization. (3-0). Credit 3.** Focus on heuristic optimization methods that search beyond local optima; includes neighborhood search methods and advanced search strategies such as genetic algorithms, simulated annealing, neural networks, tabu search, and greedy randomized adaptive search procedures. **Prerequisites:** ISEN 620 or 622 or approval of instructor.

**622. Linear Programming. (3-0). Credit 3.** Development of the mathematics and algorithms associated with linear programming; convex sets and cones, polyhedral sets, duality theory, sensitivity analysis, simplex, revised simplex and dual simplex methods; also covered are bounded variables, column generation, decomposition, integer programming; computer assignment. **Prerequisite:** MATH 304.

**623. Nonlinear and Dynamic Programming. (3-0). Credit 3.** Understanding of algorithms for nonlinear optimization; development of optimality conditions and different types of algorithms for unconstrained and constrained problems; formulation and solution of many types of discrete dynamic programming problems. **Prerequisite:** MATH 304.

**624. Applied Distribution and Queuing Theory. (3-0). Credit 3.** Queuing theory and its applications; single and multiple channels, priorities, balking, batch arrivals and service, and selected non-Markovian topics. **Prerequisite:** ISEN 609 or ECEN 646.

**625. Simulation Methods and Applications. (2-3). Credit 3.** Fundamental methodologies of simulation modeling; random number and variate generation, statistical analysis of model output, and discrete event modeling using a commercial simulation language. **Prerequisite:** STAT 212 or 601.

**626. Model Building and Applications of Operations Research. (3-0). Credit 3.** Problem-solving environment exposing students to a variety of unstructured problems in operations research requiring organization, formulation and solving an appropriate model. Selection and use of an efficient technique. Computer solution procedures. Selected readings in current literature. **Prerequisite:** Approval of instructor. Course Descriptions/Industrial and Systems Engineering 431

**627. Engineering Analysis for Decision Making. (3-0). Credit 3.** Principles and
application of techniques in analysis of decision processes involving engineering systems under uncertainty. Areas of utility and information theory as related to quantification of information for decision-making. **Prerequisites:** ISEN 609; STAT 601 or approval of instructor.

**628. Combinatorial Optimization. (3-0). Credit 3.** Formulation techniques are studied along with general approaches for solving integer and combinatorial optimization problems: basic polyhedral theory, cutting planes, branch and bound, matroids and theoretical background behind network optimization problems including the traveling salesman problem. **Prerequisite:** ISEN 620 or 622.

**629. Engineering Optimization. (3-0). Credit 3.** Develops a modern framework for studying nonlinear programming problems using convex analysis; convex sets and cones, separating hyperplanes, sub-differentiability, conjugate transforms, duality theory and parametric analysis; applications of the principles and methods will be studied. **Prerequisite:** ISEN 623; corequisite: MATH 409.

**630. Human Operator in Complex Systems. (3-0). Credit 3.** Basic understanding of the theory and practice of human factors engineering. Topics are presented within the framework of humans as functioning systems and their requirements when incorporated in hardware and software systems.

**635. Human Information Processing. (3-0). Credit 3.** Perceptual and cognitive issues as related to the design of man-machine systems; perception, central processes, decision making and other performance aspects of the human component as an information processor. **Prerequisite:** ISEN 430 or approval of instructor.

**636. Large-Scale Stochastic Optimization. (3-0). Credit 3.** Introduction to models, theory and computational methods for large-scale stochastic optimization including decomposition-coordination algorithms for stochastic programming such as generalized Benders decomposition and resource-price directive methods; emphasis on practical algorithm implementation and computational experimentation. **Prerequisites:** ISEN 620 or 622, STAT 610 and CSCE 602 or approval of instructor.

**637. Stochastic Dynamic Programming. (3-0). Credit 3.** Methodologies for stage-wise stochastic-decision processes; includes finite-horizon models, infinite-horizon discounted total cost models, and average cost models; applications of methods to various situations. **Prerequisites:** ISEN 609 and ISEN 622, or approval of the instructor.

**638. Polyhedral Theory and Valid Inequalities. (3-0). Credit 3.** Advanced knowledge of polyhedral theory and valid inequalities for (mixed) integer programming; introduction to fundamental concepts in polyhedral theory and several approaches to generation of valid inequalities; includes state-of-the-art advancements and current avenues of research. **Prerequisite:** ISEN 668.
639. Methods Improvement for Construction Engineers. (3-0). Credit 3. Application of work methods and measurements to civil engineering construction; examination of factors that affect productivity in construction; study of motivational factors; review of the principles of accident prevention. **Prerequisites:** CVEN 405 and 473 or approval of instructor. Cross-listed with CVEN 639.

640. Systems Thinking and Analysis (3-0). Credit 3. Introduction to the systems thinking process and the fundamental considerations associated with the engineering of large-scale systems, or systems engineering. **Prerequisite:** MATH 304 or approval of instructor.

641. Systems Engineering Methods and Frameworks. (3-0). Credit 3. Concepts, methodology, methods and tools for discovery, definition, analysis, design, creation, and sustainment of systems involving information, physical, and human elements; architecture modeling methods include IDEF/UPDM; systems engineering frameworks include DoDAF/MoDAF, and Zachman; analysis tools include executable architectures to assess consistency, interoperability and performance. **Prerequisites:** MATH 304 or approval of instructor.

642. Engineering Project Control. (3-0). Credit 3. Project controls bridge from information-based to physical based development processes; includes detailed design, testing of designs, design realization, and preparation of facilities for steady state operations; application of basic project control theories, tools, and methods to development projects. **Prerequisite:** Graduate classification in civil engineering or industrial and systems engineering or approval of instructor. Cross-listed with CVEN 717.

643. Strategic Construction and Engineering Management. (3-0). Credit 3. Strategic and systems perspectives applied to construction and engineering management projects, organizations, and industries; system dynamics methodology to model construction and engineering systems; understanding drivers of performance; feedback and high leverage points for performance improvement. **Prerequisite:** Graduate classification or approval of instructor. Cross-listed with CVEN 654.

644. Project Risk Management. (3-0). Credit 3. Identifies causes of risks in projects; discusses probabilistic description of risks and formulation of risk models; Bayesian methods for revising probabilities; qualitative and quantitative risk assessment; setting contingencies on budgets and schedules; risk mitigation and risk management; handling technological risk; Utility theory and game theory in management of risks. **Prerequisite(s):** STAT 601 or equivalent; graduate status in Engineering, approval of instructor. Cross-listed with: CVEN 644.

645. Lean Thinking and Lean Manufacturing. (3-0). Credit 3. Introduces the principles of lean thinking in modern manufacturing systems; philosophical, managerial
and organizational requirements studied; lean manufacturing quantitative modeling methodologies, lean manufacturing cell design and case study analysis. **Prerequisites:** ISEN 609 or approval of instructor.

**654. Manufacturing Systems Planning and Analysis. (3-0). Credit 3.** The systems perspective of a computer integrated manufacturing system; manufacturing and its various levels and the planning and control of product movement through the production system in the context of using realtime control, multiprocessor systems, network architectures and databases. **Prerequisite:** ISEN 420. Cross-listed with MEEN 648.

**655. Control Issues in Computer Integrated Manufacturing. (3-0). Credit 3.** Examines the nature of computer aided manufacturing systems with emphasis on control; an architecture for control of CAM systems is presented; control issues, problems and procedures to control CAM systems are studied and developed. **Prerequisite:** Approval of instructor. Cross-listed with MEEN 650.

**656. Virtual Manufacturing. (3-0). Credit 3.** Focus on principles of virtual reality and 3-D graphics and their application in manufacturing, automation and simulation; virtual reality modeling, motion, collision detection and networking issues studied and developed. **Prerequisite:** Approval of instructor.

**659. Modeling and Analysis of Manufacturing Systems. (3-0). Credit 3.** Analytical models applied to the description, design operation and control of manufacturing processes and systems; includes serial assembly, jobshops, FMS and cellular manufacturing configurations. **Prerequisites:** ISEN 609.

**660. Quantitative Risk Analysis. (3-0). Credit 3.** Fundamental concepts, techniques, and applications of quantitative risk analysis and risk-informed decision making for students in all engineering fields. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas. **Prerequisites:** Graduate or Senior status. Cross-listed with CHEN 660 and SENG 660.

**661. Network-Based Planning and Scheduling Systems. (3-0). Credit 3.** Fundamental theory, mathematical modeling, and algorithms of network flow models including shortest path models maximum flow and cost minimization models; out-of-kilter algorithm; pure and generalized network specializations of the primal simplex method; introduction to multi-commodity networks. **Prerequisite:** ISEN 620 or 622.

**662. Production Economics. (3-0). Credit 3.** Develop an understanding of the analytical and empirical techniques required to conduct an analysis of the magnitude and the sources of productivity change; programming and regression approaches to analyze industries include manufacturing, energy, and service systems. **Prerequisites:** ISEN 303 and ISEN 620 or approval of instructor.
663. **Engineering Management Control Systems. (3-0). Credit 3.** Integration of human relations, planning and control concepts, systems analysis and design, and principles of management oriented toward engineering functions within an organization; organizational design and administration as they impact along the product life cycle, i.e., research, design, development, production and use.

664. **Principles of Scheduling. (3-0). Credit 3.** Scheduling and sequencing for production, assembly, supply chain, logistics and service operations; relevant solution methods including algebraic, branch and bound, Lagrangian relaxation, facet generation, branch and price, heuristics and simulation; computational complexity issues. **Prerequisite:** ISEN 620 or 622 or approval of instructor.

667. **Engineering Economy. (3-0). Credit 3.** Fundamental concepts and advanced techniques of engineering economic analysis; evaluation of alternative capital investments considering income taxes, depreciation and inflation; discounted cash flow analysis of competing projects, break-even analysis and determination of rate of return on investment. Risk and uncertainty in engineering analysis. **Prerequisite:** ISEN 303 or approval of instructor.

668. **Integer Programming. (3-0). Credit 3.** Formulation principles and general approaches for solving integer (and mixed, integer linear) programs including preprocessing, cutting plane methods, branch and bound, branch and cut, branch and price, and Lagrange relaxation; classical problem structures with special-purpose solution algorithms; fundamental theory of polyhedra, methods to generate valid inequalities and computational complexity. **Prerequisite:** ISEN 620 or 622. Course Descriptions/Department of Information and Operations Management 433

669. **Software Tools for Stochastic Decision Support Analysis (3-0). Credit 3.** Overview of stochastic decision analysis; focus on Palisade Corporation's Decision Tools Suite of Excel add-in macros; topics include sensitivity analysis of Excel models, decision tree construction and analysis, and simulation within Excel. **Prerequisite:** STAT 630 or equivalent and ISEN 667.
Appendix E

Industrial and Systems Engineering Undergraduate Course Descriptions
101. **Introduction to Industrial Engineering.** (1-0). Credit 1. Introduction to industrial engineering; overview of the curriculum; presentations by faculty and industry to familiarize students with the department and the scope of industrial engineering applications.

220. **Introduction to Production Systems.** (3-0). Credit 3. Introduction to manufacturing and production systems; overview of various aspects of manufacturing systems; includes using Excel and VBA in coding and evaluating models related to production systems and other industrial engineering applications. Co-requisites: ENTC 181; STAT 211. Prerequisite: CSCE 206.

285. **Directed Studies.** Credit 1 to 4. Problems of limited scope in industrial engineering approved on an individual basis intended to promote independent study. Prerequisite: Approval of department head.

302. **Economic Analysis of Engineering Projects.** (2-0). Credit 2. Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and after-tax analysis of economic projects. Prerequisite: MATH 152.

303. **Engineering Economic Analysis.** (3-0). Credit 3. Principles of economic equivalence; time value of money; analysis of single and multiple investments; comparison of alternatives; capital recovery and tax implications; certainty; uncertainty; risk analysis; public sector analysis and break-even concepts. Prerequisite: MATH 152.

314. **Statistical Control of Quality.** (2-3). Credit 3. Quality control with statistical principles applied to quality problems, including statistical analysis, density and distribution functions, control chart concepts, and process capability analysis; laboratory exercises for exposure to basic metrology and applied statistics for quality control applications in discrete-item manufacturing systems; introduction to six-sigma principles including DMAIC and variance reduction strategies. Prerequisite: STAT 212.

315. **Production Systems Planning.** (3-0). Credit 3. Principles, models, and techniques for planning, analysis, and operation of integrated production and distribution systems; application of non-linear optimization and linear, integer, and dynamic programming models and solution methods as appropriate to capacity planning, aggregate planning, inventory planning and control under deterministic and stochastic demands, push (MRP) and pull (JIT) material flow management, production lot sizing, supply chain planning, assembly line balancing, and scheduling. Prerequisites: ISEN 220; MATH 304. Corequisite: ISEN 420.

316. **Production Systems Operations.** (3-0). Credit 3. Analytical principles of manufacturing systems design, analysis and control; emphasis on stochastic analysis; role of variability and impact on cycle time; push versus pull production strategies including Kanban and constant wip control; probability, queueing theory, Little’s Law,
heavy traffic approximations, queueing networks, and lean engineering principles. Prerequisites: ISEN 220, 424; MATH 304.

333. **Project Management for Engineers.** (3-0). Credit 3. Basic project management for engineering undergraduates; project development and economic justification; estimating; scheduling; network methods; critical path analysis; earned value management; recycling and rework; project organizational structures; project risk assessment; resource allocation; ethics; characteristics of project managers. Prerequisite: Junior or senior classification in Dwight Look College of Engineering. Cross-listed with CVEN 333 and MEEN 333.

411. **Engineering Management Techniques.** (3-0). Credit 3. Techniques relating to managing engineering activities; engineer's transition into management; engineering managerial functions; motivation of individual and group behavior; productivity assessment/improvement; managing the quality function and communications. Prerequisite: Senior classification in industrial engineering.

414. **Total Quality Engineering.** (2-3). Credit 3. Principles of total quality engineering; total quality management philosophy, engineering approaches for designing quality into products and processes; off-line experimentation methods for the robust design; emphasis on teamwork and continuous quality improvement. Prerequisite: STAT 211.

416. **Facilities Location, Layout and Material Handling.** (3-3). Credit 4. Analytical treatment of facilities location, physical layout, material flow and handling, combined with heuristic algorithms to assist in the design of production/service facilities; fundamental concepts applied through a sequence of design projects. Prerequisites: ISEN 315; ISEN 316 or registration therein.

420. **Operations Research I.** (3-0). Credit 3. Development and application of fundamental deterministic analytical methods including linear programming, integer programming, dynamic programming and nonlinear optimization. Prerequisite: MATH 304 or equivalent.

421. **Operations Research II.** (3-0). Credit 3. Development and application of probabilistic analytical methods including Markov chains, queuing systems and digital simulation modeling. Prerequisites: MATH 304 or equivalent; STAT 212.

424. **Systems Simulation.** (2-3). Credit 3. Systems simulation structure, logic and methodologies; generation of random numbers and random variates; system simulation languages, models and analysis; applications to a variety of systems such as transportation, supply chain modeling, manufacturing and service systems. Prerequisite: STAT 212.

425. **Design and Analysis of Industrial Systems with Simulation.** (2-3). Credit 3. In-depth study into the design-modeling and subsequent analysis of contemporary production/service systems; factory/service systems are modeled using the ARENA/SIMAN V simulation-animation language; emphasis is placed on the critical
analysis of alternative flow designs of modeled systems using flow and economic parameters to assess system improvement. Prerequisites: ISEN 303 and 424.

430. **Human Factors and Ergonomics.** (3-0). Credit 3. Human biological, ergonomic, and psychological capabilities and limitations; techniques and procedures for developing and applying the principles of human factors engineering to systems design; stresses interdisciplinary nature of the subject. Prerequisite: Junior or senior classification.

455. **Principles of Programmable Automation.** (2-3). Credit 3. Comprehensive treatment of the principles of computer numerical control, direct numerical control, computer-aided part programming and industrial robots; emphasis on the operations and applications of CNC, DNC machine tools and industrial robots; laboratory experience in using part-programmable software and robotic programming languages to develop programmable automation systems. Prerequisites: ISEN 316 and ISEN 416 or registration therein.

459. **Industrial Engineering Systems Design.** (1-6). Credit 3. Capstone design course emphasizing modeling, analysis and design of industrial, manufacturing, and service systems; integrates knowledge gained from all required industrial engineering courses in a comprehensive design project; to be taken in the final semester of undergraduate studies. Prerequisites: ISEN 314, 316, 416.