Dr. Jharna Chaudhuri
Professor and Chair
Department of Mechanical Engineering
Texas Tech University
Presentation to
ME Industrial Advisory Board and ME Academy Members
April, 2015
Undergraduate Enrollment History in Mechanical Engineering at TTU

Number of Students

Year


Spring
Fall
Enrollments Broken Down by Years, Spring only
Bachelor's Degrees Awarded in Mechanical Engineering at TTU

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Number of Students</th>
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<tr>
<td>06-07</td>
<td>150</td>
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<tr>
<td>13-14</td>
<td>200</td>
</tr>
<tr>
<td>14-15</td>
<td>210</td>
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</tbody>
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TTU Mechanical Engineering
FE Exam Pass Rate

% Passed

Year

Graduate Enrollment History in Mechanical Engineering at TTU
Master's and Ph.D.'s Awarded in Mechanical Engineering at TTU
TTU Mechanical Engineering Sponsored Research Awards By Faculty Home Department

Year

Research Expenditure

$0.00

$500,000.00

$1,000,000.00

$1,500,000.00

$2,000,000.00

$2,500,000.00

$3,000,000.00

$3,500,000.00

$4,000,000.00

$4,500,000.00

TTU Mechanical Engineering
Journal Publication History

Year
Number of Publications
2008 2009 2010 2011 2012 2013 2014
Student News
ME Hosts ASME District E SPDC Second Year in a Row (April 9-11, 2015)
Kate Lewis, a senior mechanical engineering student, has been accepted into the Common European Master's Course in Biomedical Engineering (CEMACUBE). This consortium prepares students from Europe and outside Europe for professions in biomedical engineering through a European dual-master program. This year, 33 students from 16 countries were accepted. Lewis was one of three Americans who will participate.
Three Texas Tech engineering students are among 123 students from 52 U.S. higher education institutions that have been named University Innovation Fellows by the National Center for Engineering Pathways to Innovation (Epicenter). Valente Rodriguez, a senior mechanical engineering major, Benjamin Simmons, a junior mechanical engineering major, and Francis Atore, a senior chemical engineering major, join two other Texas Tech students in this distinct honor.

The National Center for Engineering Pathways to Innovation (Epicenter) is funded by the National Science Foundation and directed by Stanford University and VentureWell (formerly NCIIA).
Aimee Cloutier, a doctoral student under the supervision of Dr. James Yang, has been selected to receive a travel award for the 13th Annual Regional National Occupational Research Agenda (NORA) Young/New Investigators Symposium to present her research.
Çağrı Mert Bakırcı, a doctoral student in the Department of Mechanical Engineering, was one of the speakers at TEDxTexasTechUniversity 2015 in February 2015. His research is on evolutionary biology, with a focus on evolutionary robotics, a field that tries to apply the principles of evolutionary biology to robotics and artificial intelligence.
Andrew Fillingim, an undergraduate researcher in the Biomedical Micro/Nano Device Lab, has been named one of 50 finalists for the 2015 class of Hertz Fellows. The Hertz Foundation funds graduate education for leaders in the fields of applied physical, biological and engineering sciences and encourages its awardees to pursue science for the public good.
Ikenna Ivenso, a doctoral student, was awarded the 2015 Student Research Achievement Award and a 2015 Education Committee Travel Award from the Biophysical Society. He presented his abstract at the Biophysical Society's 59th Annual Meeting, which was held in February 2015 in Baltimore, Maryland.
Shehan Haputhanthri, a doctoral student in the Department of Mechanical Engineering, won the Best Graduate Student Poster Award at the ASME 8th International Conference on Energy Sustainability and 12th Fuel Cell Science, Engineering and Technology Conference held in Boston, Massachusetts in July 2014.

His poster was titled "Ammonia as an Alternate Transport Fuel: Emulsifiers for Gasoline Ammonia Fuel Blends and Real Time Engine Performance."
Evan Vargas, a doctoral Student in the Department of Mechanical Engineering, won the Outstanding Student Presenter Award at the 2014 Spring Technical Meeting of the Central States Section of The Combustion Institute. His presentation was titled "Effects of Particle Size on Microwave Heating of Aluminum Powder Compacts."
Avik Basu and Alejandro Bilbao, mechanical engineering doctoral students, have been selected as ARCS Scholars for the 2014-2015 year by the Lubbock Chapter of the Achievement Rewards for College Students. They will be honored at an event on October 28. The Lubbock Chapter of ARCS was founded in 1972. To be eligible for an ARCS scholar award, a student must be a United States citizen; at least at the junior level and majoring in mathematics, engineering, science or medicine; and maintain a 3.5 or above grade-point average.
Zhenyi Liu, a doctoral student in the Department of Mechanical Engineering, has been named a recipient of a Society for Industrial and Applied Mathematics (SIAM) Student Travel Award to attend the SIAM Workshop on Network Science (NS14) in July 2014 in Chicago, Illinois.
Haputhanthri Wins First Place in Graduate Student Research Poster Competition

Shehan Haputhanthri, a doctoral student, won first place in Engineering Category 2 at the 2014 Graduate Student Research Poster Competition, hosted by the Texas Tech Graduate School.
Gragg Receives Second Place in Outstanding Dissertation Award Competition

Dr. Jared Gragg, who recently completed his dissertation in the Department of Mechanical Engineering, received second place in the Texas Tech Graduate School's Outstanding Dissertation Award Competition. His dissertation title was "Investigating the onset of slip in gait by employing probabilistic theory and optimization-based motion prediction." Gragg was nominated by Dr. James Yang, an associate professor of mechanical engineering.
Pawan Maharjan has been awarded an AT&T Chancellor’s Graduate Fellowship to pursue a Master’s degree in the Department of Mechanical Engineering, an honor given to outstanding prospective students of Texas Tech University.
Faculty News
Dr. Michelle Pantoya, J. W. Wright Regents Chair in Mechanical Engineering and professor, has been named to the YWCA of Lubbock's Women of Excellence academy, a program which recognizes and honors women in our community who excel in their careers. She was nominated for the award by Al Sacco Jr., dean of the Whitacre College of Engineering.
Teams of 9th-12th graders from the western half of Texas participated in the FIRST® Tech Challenge (FTC) Panhandle-Plains Regional Championship Tournament on March 3 for an opportunity to win statewide recognition for design excellence, sportsmanship and teamwork and to advance to the National Championship in St. Louis. The event will be hosted by Dr. Alan Barhorst, a professor of mechanical engineering.
Dr. Jeff Hanson, Instructor of mechanical engineering, has been named chair elect of the American Society of Mechanical Engineers (ASME) Board on Student Programs. The chair provides guidance and leadership to ASME student sections on the university and college campuses to enhance the quality, content and relevance of their activities in preparation for their professional career.
Dr. Michelle Pantoya, J. W. Wright Regents Chair in Mechanical Engineering and professor of mechanical engineering, was recently featured on the Discovery Channel Canada's program, Daily Planet. Pantoya, along with representatives from the Lubbock County Sheriff's Department, demonstrate how her research into nanoparticles has led to advances in combustion and explosions that could lead to safer ammunition, the elimination of biological threats, and many other applications.
Gray`s Artwork Featured on Texas Country Reporter

George Gray, an instructor of mechanical engineering, was recently featured on Texas Country Reporter, a weekly syndicated television program that airs on broadcast television across Texas. His artwork is available for viewing on his website at ironmongerartworks.com and the video interview is available through Texas Country Reporter's YouTube channel.
Dr. Michelle Pantoya published her fourth children book, *Engineering in Space: adventure of an Astronaut Engineer* is an exciting look into space through the eyes of an engineer. From lift-off to touch-down, engineering principles are integrated with a first-hand account of the beauty of space. The fascinating story uses rhyming and rhythm to creatively engage the reader on a journey through space.
Dr. Craig Snoeyink joined the department in September, 2014. Dr. Snoeyink is developing nano-scale optical metrology techniques and applying them towards fundamental biological and fluid mechanics questions. Dr. Snoeyink received his PhD in Mechanical Engineering from the Purdue University in 2012. Prior to joining the TTU faculty Craig was a postdoctoral research fellow at TTU.
Departmental News
<table>
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<tr>
<th>ITEM DESCRIPTION</th>
<th>ESTIMATED COST</th>
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<tr>
<td>Haas VF-2, 30&quot; X 20&quot; X 20&quot;, 5-Axis, CNC Milling Machine</td>
<td>$104,500</td>
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<tr>
<td>Haas ST-10, 14&quot; X 14&quot;, CNC Lathe</td>
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<tr>
<td>EOS Metallic 3D Printer</td>
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<td>Flow Mach 2b 1313b Waterjet</td>
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<td>Faro Arm, Coordinate measuring system 3D laser scanner</td>
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<td>Super Summit 24&quot; X 60&quot; Engine Lathe</td>
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<td>Baileigh RDB-175 Tubing Bender w/ Round Pipe Die Package</td>
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<td>Wilton/Jet 20&quot; Geared Floor Drill Press</td>
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<td>ECONOLINE Abrasive Blast Cabinet</td>
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<td>Bench Depot Student Project Work Benches</td>
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<td>Hand tool sets for student use w/ tool box</td>
<td>$1,643</td>
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<tr>
<td>Wellsaw V20 Vertical Bandsaw</td>
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<td>Accu II Milling 10&quot; X 54&quot; Machine</td>
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<tr>
<td>Summit 14&quot; X 40&quot; Engine Lathe</td>
<td>$13,464</td>
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Undergraduate Laboratory Development

- Proposals submitted to the college for renovation of three undergraduate labs and machine shop as follows:
  - Advanced Nano/Biomaterials and Nano/Biomechanics Lab
  - Advanced Energy, Exergy and Flow Lab
  - Industrial and Networked Control Systems Lab
  - Advanced Manufacturing/Prototype Lab
Undergraduate Laboratory Development

- Phillips 66 Donation: Dynamometer for Engine Experiment
- New Impact Testing Machine
- Upgraded Tensile Testing Machine
- Upgraded Control lab
- New micromilling machine for M&M Lab
Additional Space

Construction Engineering

Industrial Engineering
General Comments

• The Mechanical Engineering Department students (Undergraduate 1,524, graduate 146), faculty (35) and instructors (11) are increasing in number.

• The ME undergraduate program is well reputed as indicated by enrollment and competition among industry to recruit our students.

• Honors program in ME is working well.

• Mandatory exit exam in Design II is working well.
General Comments

- The department appreciates the Industry Projects for the Capstone Design class.
- Common syllabus and common exams at lower level courses are going well.
- Common syllabus and common course materials at upper level courses are going well.
- ABET visit in 2017
Jharna on ME Pedagogy
Report of ASME MEDH (Mechanical Engineering Department Head) Sub-Committee on ME Pedagogy
November, 2014
Jharna Chaudhuri, Professor and Chair, Texas Tech University
Incorporating New Science into Curriculum
MIT – ME Program

• **Required Course**
  Micro/Nano Engineering Laboratory
Incorporating New Science into Curriculum

MIT

Elective Courses (2 required)
Incorporating New Science into curriculum

MIT - seven areas of excellence

- **Area 1: Mechanics: Modeling, Experimentation, and Computation (MMEC)**
  - Applications span from the nano/micro world to the geophysical domain.

- **Area 2: Design, Manufacturing, and Product Development**
  - Application to Design that Matters, Formula SAE, Satellite Engineering Team, Solar Electric Vehicle Team. Flagship products for new companies and are entered in the MIT $100K Entrepreneurship Competition.

- **Area 3: Controls, Instrumentation, and Robotics.**
  - Applications include health care, security, education, space and ocean exploration, autonomous systems in air, land, and underwater environments.

- **Area 4: Energy Science and Engineering.**
  - Applications to high performance combustion engines, batteries and fuel cells, thermoelectricity and photovoltaics, wind turbines, and efficient buildings.
Incorporating New Science into curriculum

MIT - seven areas of excellence

- **Area 5: Ocean Science and Engineering**
  
  Applications include navigation of underwater vehicles and smart sensors for ocean mapping and exploration; biomimetics studying marine animals; ultradeep ocean gas and oil extraction.

- **Area 6: Bioengineering**
  
  Applications include understanding, diagnosing, and treating diseases, drug discovery and drug development; tissue-engineering.

- **Area 7: Nano/Micro Science and Technology**
  
  Applications include MEMS and NEMS, energy conversion at nano and microscales, 3D nanomaterials, etc.
MIT Physics – Active Learning Class Room
Primary Goal

• To establish a highly collaborative, hands-on, computer-rich, interactive learning environment
• To teach large classes
• To retain women and minorities
Approach or Teaching Style

• No face to face lecture (video lectures, online quizzes)
• 3 students at each table (lab tops)
• Work on problems, projects and discussion (Socratic-like dialogue)
• Instructor work with each team separately
Impacts

• More Responsibility on students
• Ability to solve problems is improved
• Conceptual understanding is increased
• Attitudes are improved
• Failure rates are drastically reduced, especially for women and minorities
• "At risk" students do better in later engineering statics classes
Report of ASME MEDH Sub-Committee on ME Pedagogy – March, 2015 – Also TECAID Program
Jharna Chaudhuri
Professor and Chair
ASME- TECAID (Transforming Engineering Culture to Advance Inclusion and Diversity) Project

- Michigan Technological University
- University of Oklahoma
- Oregon State University
- Purdue University
- Texas Tech University
# Enrollments\Representation in Mechanical Engineering for 2013-2014 School Year

<table>
<thead>
<tr>
<th>Enrollments</th>
<th>Number in Mechanical Engineering Department</th>
<th>Percent Underrepresented Racial/Ethnic Minority*</th>
<th>Percent Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduates Enrolled</td>
<td>1336</td>
<td>28.79</td>
<td>12</td>
</tr>
<tr>
<td>Graduates Enrolled</td>
<td>149</td>
<td>27</td>
<td>9</td>
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<tr>
<td>Tenured/Tenure-track Faculty Employed</td>
<td>35</td>
<td>5.7</td>
<td>14.28</td>
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Increase Diversity

Increase number of women students in the department of Mechanical Engineering at Texas Tech University
Cumulative continuation rate and graduation rates of female students in the Department of Mechanical Engineering at Texas Tech University

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Head Count</th>
<th>Continued to 2nd Year</th>
<th>Continued to 3rd Year</th>
<th>Continued to 4th Year</th>
<th>Grad. within 4 years</th>
<th>Continued to 5th Year</th>
<th>Grad. within 5 years</th>
<th>Continued to 6th Year</th>
<th>Grad. within 6 years</th>
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Increase Diversity

Focus on increasing the retention rate of women within mechanical engineering department
Vision of a fully inclusive mechanical engineering program

- Faculty, staff and students who are represented in numbers that are consistent with their representation in the region that the university serves
- All students in the program have an equal chance for success
- Sustain a culture in the classroom, the lab, the field and in the hallways that is welcoming to diverse populations
Departmental goals

• A need to diversify engineering culture as indicated by improved representation of women and minorities as students, faculty and staff

• An effort to increase the utilization of inclusive pedagogies that will improve student learning
Barriers

Lack of preparation

• Moving successful students from Pre-Engineering- Foundational- ME Major –
• Mathematical Skills
• Nature of Mechanical Engineering
Plan

• Focusing on the at-risk female students in the pre- and Foundational Engineering pools

• Mentoring and introduction to female mechanical engineers who are currently in the field

• Education about implicit biases for all engineering students

• Tutoring

• curricular enhancements that address women’s interests and styles of learning.

• Introducing to Undergraduate Research