Engineering Programs

- 12 Undergraduate programs:
  - Aerospace Engineering
  - Biomedical Engineering
  - Biosystems Engineering
  - Civil Engineering
  - Chemical and Biomolecular Engineering
  - Computer Engineering
  - Computer Science
  - Electrical Engineering
  - Industrial Engineering
  - Material Science and Engineering
  - Mechanical Engineering
  - Nuclear Engineering

- Interdisciplinary Themes

How do Aerospace Engineers affect society?

- AEs research, develop, and design aircraft and spacecraft components and systems for government, military and commercial enterprises.

- Systems and components can involve technologies associated with propulsion, airframe, avionics, aerodynamics, sensors, and light-weight materials. AEs are also involved in flight testing and flight performance evaluation.

What’s happening in AE at UT?

Areas of Study & Projects:  
- Aerodynamics
- Airplane performance
- Astronautics
- Compressible flow
- Propulsion – rocketry
- Aero-structures
- Guidance and control
- Low gravity effects
- Atmospheric Studies

How do Biomedical Engineers affect society?

- BMEs research, develop and design technologies and products used in medicine and medical research including medical instruments, medical imaging, prosthetics and tools for rehabilitation.

- BMEs often work closely with physicians and other health care providers. Many BMEs also attend medical school or get BME graduate degrees.

What is happening in BME at UT?

Areas of Study and Projects:  
- Biomechanics
- Physiology
- Biomaterials
- Bioinstrumentation
- Biosensors – micro-electromechanical systems
- Orthopedic implants - design and clinical evaluation
- Clinical studies
- Surgical navigation
Biosystems Engineering - What we do

- The application of engineering principles to the complex biological systems that make up most of the natural world.
- Examples:
  - Bioenergy and energy conversion
  - Natural resource management
  - Environmental protection
  - Water quality
  - Forest engineering
  - Food processing
  - Agricultural applications
  - Aquacultural production
  - Ecological engineering
- Enjoy the outdoors!
- Also have a Pre-Professional Curriculum (Pre-Med, Pre-Dental, Pre-Vet)

Biosystems Engineering - Program Strengths

1) The breadth of the curriculum provides:
- Exposure to course content from Mechanical, Civil, Electrical, and Chemical Engineering
- Unique preparation to work in "systems" types of engineering jobs - the big picture
- Ability to readily adapt to new or future technologies and demands - not tied to any current approach or technology
2) The emphasis on design
- Start in freshman year in BS104 Design Apprenticeship, culminating in a Senior Design Project which takes a real design from problem definition through testing of the solution prototype.

Enjoy the outdoors!

Also have a Pre-Professional Curriculum (Pre-Med, Pre-Dental, Pre-Vet)

Civil and Environmental Engineering

- Civil Engineering
- Construction
- Environmental Engineering
- Air Quality
- Water Resources
- Waste Management
- Water Quality
- Transportation

Chemical and Biomolecular Engineering

Chemical/Biomolecular Engineers are trained to:
- Understand the fundamentals of physical, chemical, and biological processes.
- Discover, analyze, and manipulate molecular-scale properties of materials, cells and biomolecules, and the environment.
- Develop new processes and products that are essential in everyday life, advancing human health, and improving environmental conditions.

Chem/Biomol Engineers work in:
- Biotechnology, pharmaceuticals, and health care
- Gene therapy
- Vaccine production and design
- Biopharmaceutical development and production
- Bioenergy production
- Tissue engineering
- Advanced materials
- Electronics
- Fuel cell membranes
- Nanomaterials
- Biomaterials
- Environmental health, waste remediation, climate modeling
- Management consulting, venture capital
- A wide range of other industries

CEE: Impact on Society

Air Pollution Control
- Developing air pollution control plan for 2008 Beijing Olympics
- Water Quality
- Effects of acid rain on water quality and fish in Smoky Mountains

Critical Infrastructure Needs
- Rehabilitating the aging infrastructure, and protecting it against natural and manmade hazards
- Water Supply
- Water project in Dominican Republic
- Large International Firms, Consulting Companies
- Industry
- Construction

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- Gene therapy
- Vaccine production and design
- Biopharmaceutical development and production
- Bioenergy production
- Tissue engineering
- Advanced materials
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- Fuel cell membranes
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Exciting Events in CBE @ UTK

National Design Competitions
- EPA, Washington, DC

National Student Meetings
- New Orleans, LA

Student Research in Faculty Labs
- Drug & Gene Delivery
- Nanomaterials
- Biohydrogen Production

Innovative New Program in Biomolecular Engineering
What does a Computer Engineer do?

- Design cutting-edge systems...
- Broad areas include:
  - Communication networks - remote video systems, real-time streaming multimedia engines, network routers and switches
  - Embedded systems - autonomous control of vehicles
  - Robotic systems - autonomous control of vehicles
  - Embedded systems - cell phones, PDAs, automotive systems, as well as almost all consumer electronic products sold today
  - Reconfigurable computing - design chips that perform real-time tasks
  - Biomedical application - equipment for real-time processing of biomedical signals
- Potential employers:
  - Almost all large corporations need computer engineers
  - Government agencies have strong emphasis on computer-based systems
  - High-tech industry relies heavily on computer engineering

What does a Computer Scientist do?

- Create, design, and maintain advanced software systems
- Develop algorithmic processes that describe and transform information
- Broad areas include:
  - Scientific and parallel computing
  - Software engineering/reliability
  - Image processing and pattern analysis
  - Algorithms and computation theory
  - Robotics, embedded systems, machine learning, AI
  - Visualization, graphics, and gaming
- Potential employers:
  - Almost all large corporations and most businesses need computer scientists
  - Government and research institutions

What does an Electrical Engineer do?

- Design, develop, and test electrotechnology solutions
- Combines the latest technology with established electrical and magnetic principles
- Broad areas include:
  - Electronics - analog and digital, neuromorphic circuits, microelectronics, VLSI circuits, system on a chip
  - Signal/image processing - pattern/face recognition, sensor networks, robotics, bioinformatics, data mining
  - Communications - wireless communications, radio frequency to microwave frequency, antennas, cell phones, industrial plasmas
  - Power Systems/Power Electronics - fuel cells, solar cells, hybrid electric vehicles, electric machines, electric utility planning
  - Control Systems - aeronautics, motor drive control
- Potential employers:
  - Many companies have electrical engineering needs.
  - Government agencies have strong emphasis on electrical engineering for future technology.
  - Electrical engineering is a pervasive technology as many systems depend on electronics and electric power.

Computer Engineering at UT

- UT has a broad range of teaching and research activities in the Computer Engineering program
- Multiple large robotics research groups that study and design state-of-the-art artificial intelligence systems
- Variety of communication networks research activities
  - High-performance Internet switches and routers
  - Wireless sensor networks
  - Real-time ubiquitous computing
  - Digital communications
  - Reconfigurable computing - design chips that can be reconfigured to perform diverse tasks in real-time
- Classes include hands-on experience in design and testing of computer-based systems
- We emphasize system-level thinking in both research and teaching - a real edge in the marketplace

Computer Science at UT

- Broad range of teaching and research:
  - Multiple research laboratories including
    - Center for Intelligent Systems and Machine Learning: multidisciplinary study of machine learning
    - Distributed Intelligence Laboratory: cooperative robotics and AI
  - Systems that combine hardware and software
  - Image processing and multisensor fusion techniques.
- Potential employers:
  - Almost all large corporations and most businesses need computer scientists
  - Government and research institutions

Electrical Engineering at UT

- UT has a broad range of teaching and research activities in the Electrical Engineering program
- Analog mixed-signal circuit design for chips on future NASA rover and other NASA missions
- Electronics and MEMS for biosensors and microfluidics
- Robotics designs for military and civilian uses
- Image processing and multisensor fusion techniques
- Electromagnetics and antenna design for microwave frequency
- Power electronics for hybrid electric vehicles and interface with solar cells or fuel cells
- Power system analysis and utility planning
- Most classes include hands-on experience in design/testing of electrical and/or magnetic systems
- We emphasize system-level thinking in both research and teaching - a real edge in the marketplace
**Industrial & Systems Engineering**

*DEVELOPING EFFECTIVE PROCESSES*

- Statistics
- Simulation & Modeling
- Optimization
- Value Creation
- Human Factors

*FOR SYSTEMS THAT RUN THE WORLD!*

- Logistic Systems
- Healthcare Systems
- Transportation Systems
- Production Systems
- Energy Systems
- Defense Systems

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**NEW FACILITIES AND A NEW NAME**

*4th & 5th Floor of Tickle Hall (John Tickle UT BSIE '65)*

*ONE GREAT OPPORTUNITY*

- Highest 2013 UT CoE Placement
- Only IE Degree in Tennessee
- We develop LEADERS!

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**What Do Materials Scientists and Engineers Do?**

- Processing
- Manufacturing
- Testing
- Design
- Maintenance
- Research

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**What’s happening in MSE at UT?**

- ~ $5 M in annual research funding
- ~ $60K per year in MSE Undergrad Scholarship
- Research opportunities for freshmen & sophomores
  - Research at UT, ORNL, and other places
  - Attending major international conferences to present research results
- Biomaterials and Nanomaterials Concentrations
- Curriculum features hands-on lab courses
- 8 MSE faculty hold joint appointments with ORNL
- UT-ORNL Joint Institute for Advanced Materials under construction
- Low student-to-faculty ratio

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**How do mechanical engineers affect society?**

- ME is a broad area, impacting almost every area of society. MEs are employed in almost every field.
- MEs work on many systems including power plants, medical devices, combustion engines, automobiles, ships, robotics, aircraft, control systems, manufacturing devices and processes, sensors, fuel cells, batteries, turbines, pumps, air-conditioning and refrigeration systems...etc.

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**What’s happening in ME at UT?**

**Some Areas of Study**

- Hybrid Vehicle Design
- Medical Devices
- Controls
- Robotics
- Fluid Mechanics
- Dynamics
- Combustion
- Fuel Cells
- Solid Mechanics
- Thermodynamics
- Vibrations
- Heat Transfer

- Smart Materials
- Modeling
- Medical Imaging
- Fuel Cells
- and Robotics
Examples of What Nuclear Engineers Do

- Nuclear Power
- Nuclear Medicine
- Space Exploration
- Oil Exploration
- Industrial Measurements
- Food Preservation

Nuclear Engineering at UT

- UT Nuclear Engineering Department founded in 1957
  - Produced over 1000 graduates in the past 54 years
- Abundant undergraduate scholarships
  - No out-of-state tuition for UTNE students from AL, AR, LA, MS, SC, KY, DE, VA, WV (Savings of over $12,000 per year)
- Master Student Program
  - Earn both BS and MS in five years or less
- Close ties with the nearby Oak Ridge Nuclear Complex
- Outstanding record in National Student Design Contest
  - UTNE students have been Contest Finalists in 32 of past 35 years
- Nuclear power renaissance means high demand for nuclear engineers now and in the future in both the U.S and worldwide

Get Involved in Your Education

- International experience
- Undergraduate research
- Student society and leadership activities

Questions?