LEONARD H. O. SPEARMAN TECHNOLOGY BUILDING

COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY

TEXAS SOUTHERN UNIVERSITY

LABORATORY INFRASTRUCTURE

THE LEONARD H. O. SPEARMAN TECHNOLOGY BUILDING

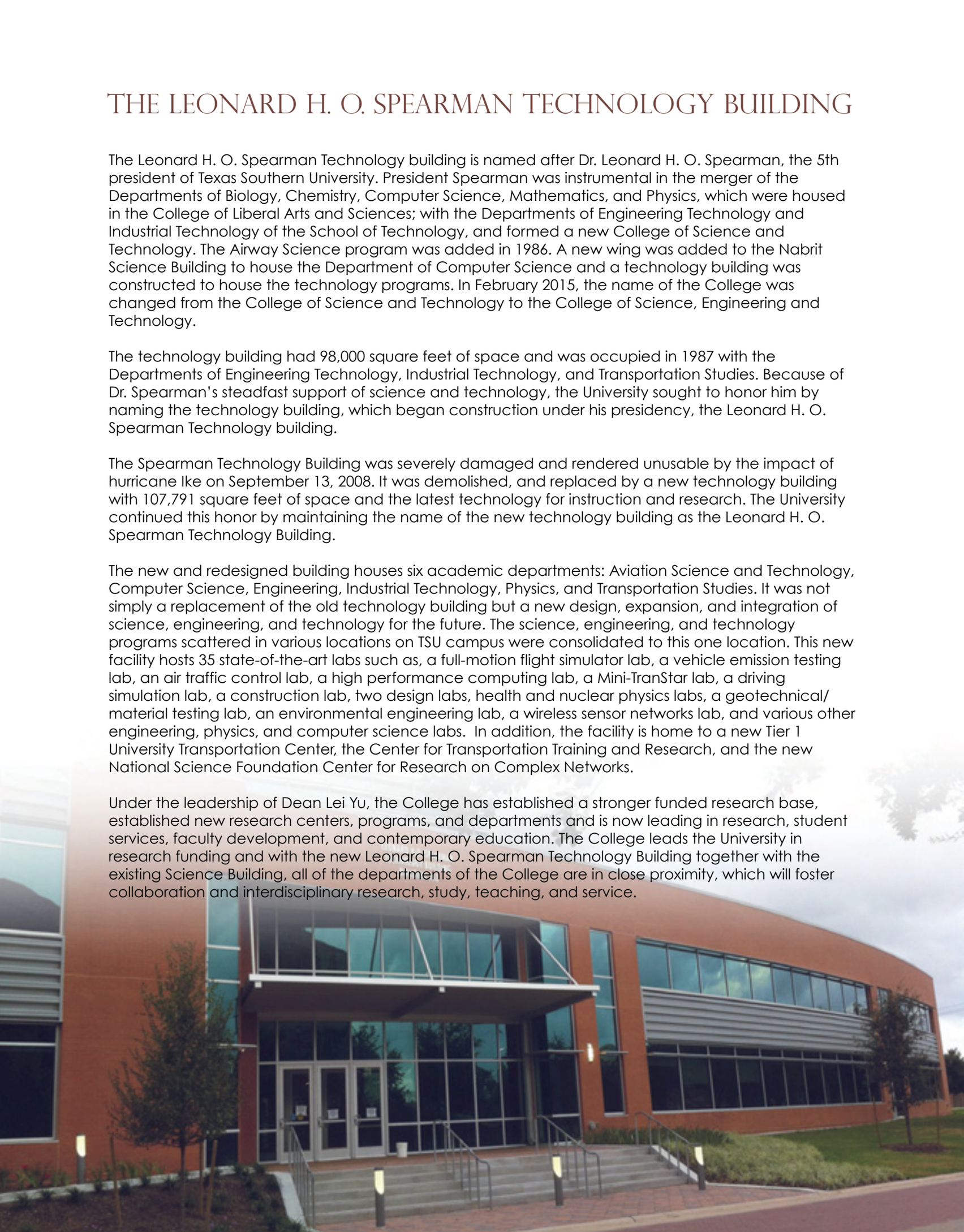
The Leonard H. O. Spearman Technology building is named after Dr. Leonard H. O. Spearman, the 5th president of Texas Southern University. President Spearman was instrumental in the merger of the Departments of Biology, Chemistry, Computer Science, Mathematics, and Physics, which were housed in the College of Liberal Arts and Sciences; with the Departments of Engineering Technology and Industrial Technology of the School of Technology, and formed a new College of Science and Technology. The Airway Science program was added in 1986. A new wing was added to the Nabrit Science Building to house the Department of Computer Science and a technology building was constructed to house the technology programs. In February 2015, the name of the College was changed from the College of Science and Technology to the College of Science, Engineering and Technology.

The technology building had 98,000 square feet of space and was occupied in 1987 with the Departments of Engineering Technology, Industrial Technology, and Transportation Studies. Because of Dr. Spearman's steadfast support of science and technology, the University sought to honor him by naming the technology building, which began construction under his presidency, the Leonard H. O. Spearman Technology building.

The Spearman Technology Building was severely damaged and rendered unusable by the impact of hurricane Ike on September 13, 2008. It was demolished, and replaced by a new technology building with 107,791 square feet of space and the latest technology for instruction and research. The University continued this honor by maintaining the name of the new technology building as the Leonard H. O. Spearman Technology Building.

The new and redesigned building houses six academic departments: Aviation Science and Technology, Computer Science, Engineering, Industrial Technology, Physics, and Transportation Studies. It was not simply a replacement of the old technology building but a new design, expansion, and integration of science, engineering, and technology for the future. The science, engineering, and technology programs scattered in various locations on TSU campus were consolidated to this one location. This new facility hosts 35 state-of-the-art labs such as, a full-motion flight simulator lab, a vehicle emission testing lab, an air traffic control lab, a high performance computing lab, a Mini-TranStar lab, a driving simulation lab, a construction lab, two design labs, health and nuclear physics labs, a geotechnical/ material testing lab, an environmental engineering lab, a wireless sensor networks lab, and various other engineering, physics, and computer science labs. In addition, the facility is home to a new Tier 1 University Transportation Center, the Center for Transportation Training and Research, and the new National Science Foundation Center for Research on Complex Networks.

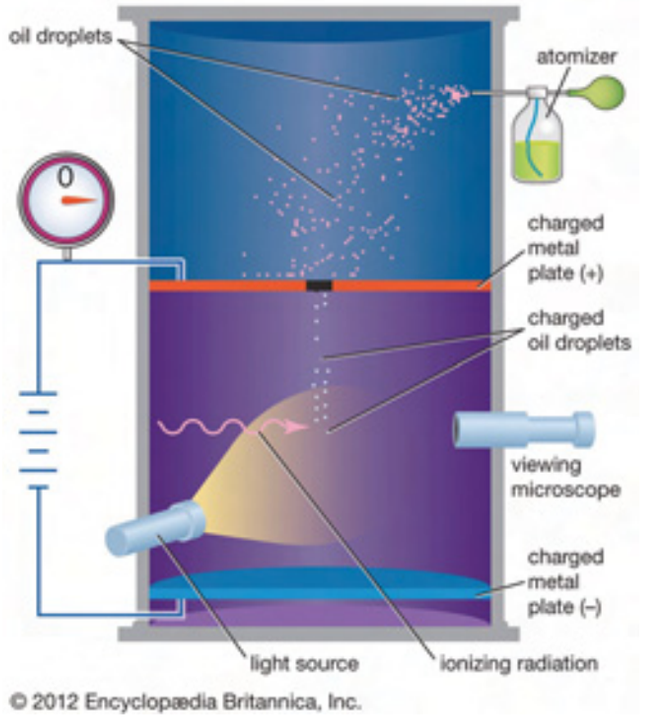
Under the leadership of Dean Lei Yu, the College has established a stronger funded research base, established new research centers, programs, and departments and is now leading in research, student services, faculty development, and contemporary education. The College leads the University in research funding and with the new Leonard H. O. Spearman Technology Building together with the existing Science Building, all of the departments of the College are in close proximity, which will foster collaboration and interdisciplinary research, study, teaching, and service.



CONTENTS

Advanced Undergraduate Physics Lab TECH 240

DEPARTMENT OF PHYSICS



Millikan Oil Drop Experiment

There are key experiments in the history of physics that revolutionized our way of thinking about the fundamental structure of nature and the ensuing laws that characterize physical processes. Some of these experiments can be done by upper level physics majors. These experiments also serve to expose the student to advanced skills indispensable in today's advancing technological evolution impacting many industries. Some of the more traditional experiments include:

Michelson Morley interferometer Experiment which confirmed the invariance of the speed of light in a vacuum. This experiment formed the basis for the famous $E = mc^2$ relation which is at the heart of nuclear fission (i.e. atomic bombs, nuclear power plants, etc.) and nuclear fusion (the energy from the sun, and potentially future energy machines which produce less radioactive bi-products than conventional nuclear power plants).

Millikan Oil Drop Experiment – that measured the charge on an electron.

X-Ray Diffraction for discovering the crystal structure of compounds.

Davisson Germer Experiment which revealed the duality principle of matter (i.e. what we call a particle can sometimes behave as a wave) – "matter waves."

Nuclear Magnetic Resonance – atomic nuclei, when placed in magnetic fields, will occupy different energy levels that can be excited and de-excited through electromagnetic radiation. This is relevant in many fields, particularly medicine.

Other important experiments impact nuclear physics, laser physics, semiconductors, superconductivity, nanostructures, etc.

These labs are the cornerstone of a student's immersion into, and understanding of, physics. Physics lab courses are the stepping stones into student's participation in faculty led research. This Lab ensures the production of high caliber students able to assist faculty in their research efforts .

Airport Management Lab

TECH 151

DEPARTMENT OF AVIATION SCIENCE AND TECHNOLOGY

In the Airport Management lab, which also serves as a class room, students will learn basic principles of airport operations, airfield signage markings and lighting, and driving on the airport operations area.

The two simulators depict the airfield at several different airports including Tampa, Florida and Houston Hobby airport. Students learn to communicate with the Air Traffic Control Tower to get permission to cross runways and/or taxiways, and to conduct runway/taxiway inspections per Federal Aviation Regulation PART 139 which governs all commercial service airports in the United States.

It is imperative that students learn what the runway and taxiway markings mean, as well as the various signs on the airfield and lighting. Students will be able to recognize the colors of runway lighting and what each color means to a pilot. Students will know the color of taxiway lighting, to include high-speed taxiway lighting, and all lighting and signage pertaining to Surface Movement Guidance and Control Systems for low visibility operations.

This training helps students that are seeking positions at Airports, Fixed Base Operators, and General Aviation Airports. At commercial airports, the airport operations sections conduct airfield inspections, to include the runway and taxiways and the airfield as a whole.

Currently there are several TSU Aviation Science and Technology graduates working for the Houston Airport System at Bush Intercontinental Airport and William P. Hobby Airport in airport operations. We have several graduates and current students working as line technician at Fixed Base Operators, at Hobby, Bush Intercontinental, and Houston Southwest Airports.

Airport Operations

Airfield Signage Markings

Airfield Lighting

Driving on Operations Area

Air Traffic Control Lab

TECH 153

DEPARTMENT OF AVIATION SCIENCE AND TECHNOLOGY

In the Air Traffic Control (ATC) Lab, students learn the rules and regulations as they pertain to air traffic control:

Aircraft separation standards

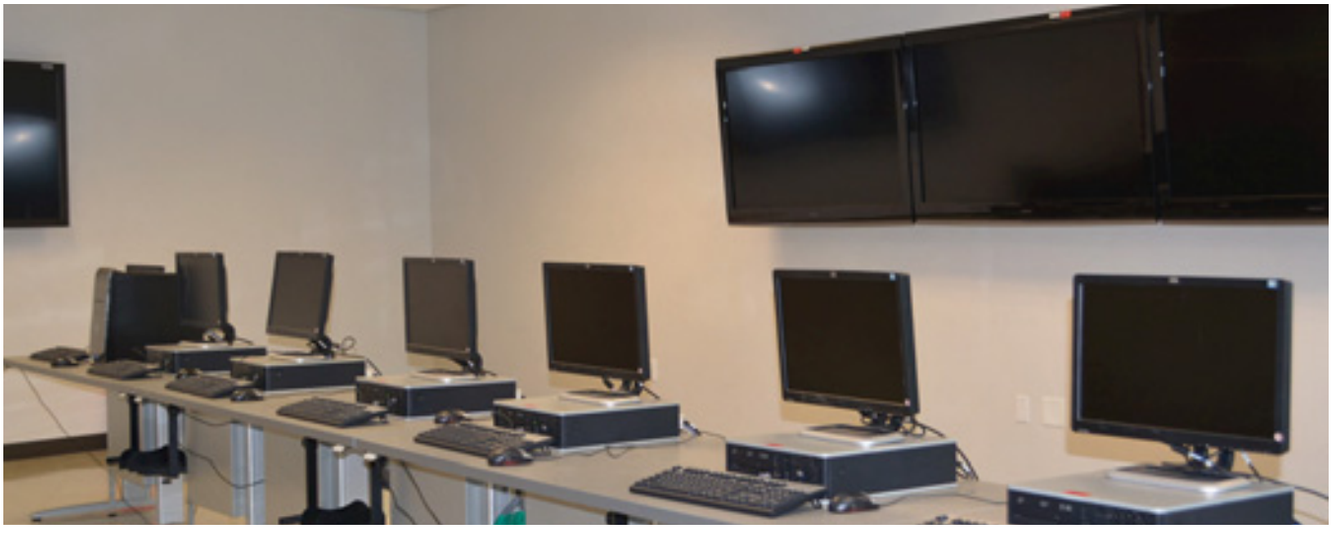
ATC tower operations

RADAR operations

The ATC lab is equipped with six simulated presentations and a tower presentation of the airfield at Hobby airport. Students apply the rules and regulations to simulated aircraft flying in the Houston area as well as aircraft operating in/out of Hobby airport. They learn proper phraseology as it pertains to ATC when issuing clearances to land or take off, or course headings when flying from one point to another. This includes Visual Flight Rules and Instrument Flight Rules. These rules apply to certain pilots with the proper ratings to fly under various conditions.

From an airport management perspective, having the basic knowledge of ATC procedures and regulations allows a better understanding of airport, the airport movement area, why runways and taxiways are designed the way they are, and for what purpose. Runway alignments contribute to capacity issues, as to how many aircraft can land at an airport per hour. It also helps when handling aircraft emergencies and incidents.

Having knowledge of the basic ATC rules and regulations, as well as how to apply those rules and regulations gives our students an advantage when applying for ATC positions with the FAA as entry level air traffic controllers. Currently, there are two graduates of the program that are air traffic controllers, and one graduate that works for the FAA as a computer specialist.



Computer Aided Design Lab I

TECH 158

DEPARTMENT OF INDUSTRIAL TECHNOLOGY

Students enrolled in classes in this lab will be exposed to advanced technical graphics. The laboratory is equipped with the latest high-tech graphics producing computers, plotters, and printers. These computers are loaded with the latest 2D and 3D graphics software packages such as:

Unigraphics NX

Solid Edge

AutoCAD

Students will be trained in CAD courses ranging from beginner to advanced in architectural, mechanical, and engineering Design. Students will be exposed to descriptive geometry applications such as folding line relationships and notations, angles between plane revolutions and intersections. Students will also learn to develop working drawings for residential and light commercial buildings along with space planning and design in buildings with code requirements. Also, students will be exposed to solid modeling of mechanical and electrical/electronic components and assemblies. In addition, students will be required to produce and maintain portfolios of their completed work for Departmental presentations and prospective job interviews.

Graduates receiving training in this laboratory will be equipped with not only application skills but management-oriented technical skills required in the design industry. Students will acquire problem-solving skills and develop teamwork attributes in completing graphic problems. In addition, graduates in the design program are expected to seek job opportunities such as: CAD Section Leader, Project Lead Designer, and Technical Illustrator in a high-tech manufacturing environment. Student work portfolios will greatly enhance employment opportunities for design graduates.

The equipment and software available in the computer-aided design laboratory will provide students conducting research to enhance presentations requiring quality graphics. Materials such as book illustrations, product brochures, 2D and 3D architectural and engineering graphics can be produced in this laboratory.

Computer Aided Design Lab II

TECH 160

DEPARTMENT OF INDUSTRIAL TECHNOLOGY

Students taking classes in this lab will be trained in advanced piping facility design, architectural rendering, and machine design. The laboratory is equipped with the latest high-tech graphic producing computers and printers. These computers are loaded with the latest AVEVA 3D Piping System Design software along with AutoCAD. Students will be trained in CAD courses ranging from beginner to advanced where emphasis will be placed on geometrical construction, along with orthographic and axonometric projection. Students will also be exposed to design of machine components such as thread and gear creation. Training will be provided relative to architectural artistic requirements such as perspectives, shapes, shadows, and color presentations. Students will learn piping terminology, piping equipment, fittings, and instruments. Modeling and drafting of concrete, steel, and wooden structures will be discussed. In addition, design evaluation of building and structural integrity with respect to bending and compressive loads will be presented.

Graduates in the design program are expected to seek job opportunities such as: Piping Designer, Structural Detailer, and Technical Specialist in a high-tech manufacturing environment.

Student work portfolios will greatly enhance employment opportunities for design graduates.

Materials necessary in producing technical product brochures, advanced piping illustrations, and plans for residential and light commercial construction can be produced in this laboratory.

Computer Literacy Lab

TECH 338

DEPARTMENT OF COMPUTER SCIENCE

The Computer Literacy Lab is involved with training students in the fundamental concepts of computing: how computers work, what they can do, and how they can be used effectively. Topics covered in this laboratory are the following:

Spreadsheets

Word Processing

Databases

Presentation Software

Multimedia/Graphics Software

Program Design and Implementation

Fundamental computing theories

Computer programming applications using VISUAL BASIC and design, implementation, and testing of programs and graphical user interfaces

Advanced study of application software development in the WINDOWS environment

Computers have touched every part of our lives: the way we work, the way we learn, the way we live, even the way we play. It almost is impossible to go through a single day without encountering a computer, a device dependent on a computer, information produced by a computer, or a word that was introduced or whose meaning has changed with the advent of computers. Because of the significance of computers in today's world, it is important to be computer literate. Being computer literate means you have knowledge and understanding of computers and their uses.

Computer Physics Technology Lab TECH 247

DEPARTMENT OF PHYSICS

A Trans-Texas Videoconference Network (TTVN)-system for real-time and recorded course delivery

Recording facility for most of the courses

Advanced Smart-Boards to facilitate course delivery

This Laboratory represents a link to the outside world of expanded learning opportunities for our students. Students and faculty members will be able to participate in Distance Learning courses in specialized areas not represented within the Department.

This facility currently supports TSU-Physics' participation within the Texas Physics Consortium (TPC) which includes eight other campuses across the State, pooling their curriculum resources and expanded faculty specializations (i.e. Astronomy, Cosmology, Geophysics, etc.). The other physics programs participating in the TPC include Midwestern State University, Prairie View A & M University, Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, Tarleton State University, Texas A & M University – Commerce, West Texas A & M University, and Texas A & M University-Central Texas.

Expanding the course offerings available to TSU students will make them more competitive in their post-graduate career objectives. The production of well trained students is essential for sustaining TSU's research activities. This classroom contributes to the learning process in a very modern way, ensuring the production of the best trained TSU students possible, able to impact ongoing, faculty led, research.

Construction Lab

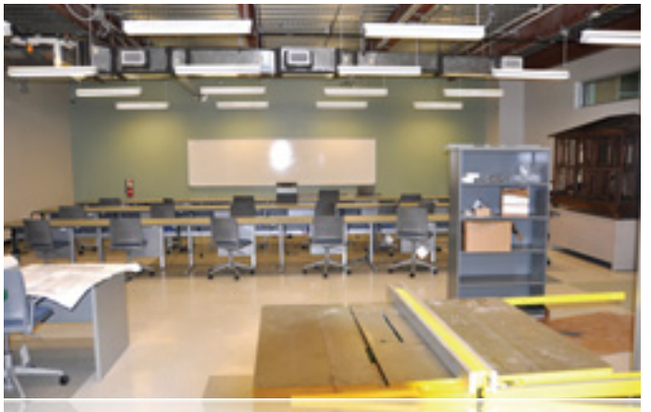
TECH 161

DEPARTMENT OF INDUSTRIAL TECHNOLOGY

The Construction Laboratory is equipped with high-tech machines such as: Table Saw, Band Saw, Planer/jointer, and a Radial Arm Saw. These pieces of equipment will be used to give students hands-on experiences in residential house construction and cabinet-making. Students will learn the proper use and care of high-tech power equipment and understand appropriate use of construction materials in the industry. Students will learn basic house wiring and HVAC installation in residential structures. In addition, students will be trained to produce scaled models of residential and commercial structures.

Students majoring in Construction Technology will receive state-of-the-art training in construction processes and procedures demonstrated in this laboratory. Students will receive coursework in construction materials and methods, framing principles, models and presentations, and concrete technology. The Department encourages students to take advantage of co-op and internship opportunities to obtain experience prior to graduation. Graduates are expected to seek management-oriented positions in high-tech manufacturing environments such as construction project managers, estimators, and inspectors.

Students trained in the construction laboratory will be prepared to produce physical presentations of structures approved through appropriate research. The construction laboratory will serve to enhance research opportunities initiated within the Department of Industrial Technology.



Construction Methods

Construction Materials

Framing Principles

Models and Presentations

Concrete Technology

Control Lab

DEPARTMENT OF ENGINEERING

Students will analyze and design control systems with an emphasis on control software, programmable controllers and data acquisition. They will perform experiments which emphasize the practical aspects of control principles while studying the feedback provided by control systems. Students will learn the control modes and methods of implementation by analog and digital means.

Students will have experience with hands-on troubleshooting, maintenance and optimization of electronic control systems; proven technical leadership, and systems-level understanding of observatory functions. All this is necessary for the job market.

The department will now be able to host a number of research opportunities in the area of software development to meet real world goals and functions. This can help in the development of advanced technology and artificially intelligent systems.

Electronic Control Systems

Programmable Controllers

Control Softwares

Artificial Intelligence

Software Development

Data Acquisition

Troubleshooting

Maintenance and Optimization

Database Lab

TECH 335

DEPARTMENT OF COMPUTER SCIENCE

This lab's main focus is:

Advanced programming techniques and data structures including tables, linked lists, queues and stacks, abstract data types, recursion, searching and sorting, hashing, binary trees.

External storage devices, file organization, file processing techniques.

Theory and current practices in database management systems, database design, data modeling and normalization, query optimization, functional dependencies, data integrity, and data security.

Data organizational models, including hierarchical and networked, with relational and semantic models stressed.

Traditionally, databases contain data that are both exact and highly structured. However, many modern applications (e.g., sensor networks, satellite images, Web text extraction) require the storage of data that have neither of these characteristics. The data may have contradictory pieces of information, and could be of only uncertain correctness. Dealing with uncertain data in an effective and systematic manner is a challenging and important issue that requires solutions for many different problems; for example, modeling of uncertain or probabilistic data, semantics for querying, and efficient query-evaluation algorithms.

Databases make sense, they bring and maintain order, they force the user to think in a very logical and linear path, and they are flexible. A database is truly an invaluable tool for any organization. There are a lot of research opportunities.

Driving Simulation Lab

TECH 255

DEPARTMENT OF TRANSPORTATION STUDIES

The Driving Simulation Lab has a state-of-the-art motion capable high-fidelity driving simulator. The visual display consists of 3 large screens with 135-degree wide-angle field of view. In addition, auditory feedback is provided through stereo components. A motion – platform provides initial cues in the form of pitch and longitudinal motion. A validated vehicle dynamics program governs the behavior of the vehicles in the simulation. All of these provide a true-to-life, scientifically validated driving experience.

Students will have comprehensive training on various aspects including the design and creation of testing scenarios and the design of posterior questionnaires. Students will be well equipped with skills such as experimental design, computer programming, software application, questionnaire administration, roadway design, and traffic signal timing. With this training, students will be equipped with practical experiences in traffic operations, transportation safety, intelligent transportation systems and technology, and even transportation psychology. Students will have better and broader job opportunities in transportation management centers (e.g. Houston TranStar), metropolitan planning organizations (e.g. Houston-Galveston Area Council), and various private companies and government agencies. The driving simulator is a very powerful tool for conducting advanced transportation research including:

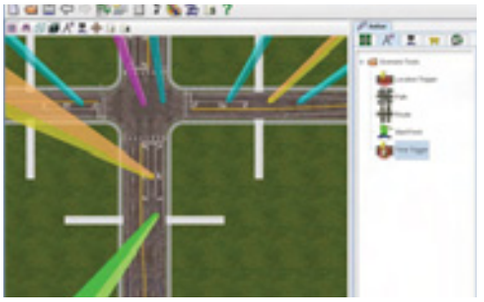
Assessment of Intelligent Transportation System (ITS) concepts

Driver preference and acceptance research

Accident analysis and development of crash avoidance counter-measures

Design and evaluation of automotive products and technologies

It has been, and will continue to be an essential research asset to enhance research productivity and funding opportunities for TSU.



Electronics Computer Lab

TECH 256

DEPARTMENT OF ENGINEERING

This lab will help students to stay current with modern software and latest technology trends in electronics engineering.

Students will be exposed to structured methods for developing complex technology computer programs using high level programming in a networked environment. The C++ language as a problem-solving tool will be emphasized. Writing industrial application programs such as floating point mathematical routines and special purpose languages utilizing micro assemblers will be taught.

Students will receive hands-on experience in high-level, object-oriented language programming using JAVA, which includes inheritance and polymorphism, implementing hiding, and the creation of JAVA applets for internet usage.

Students will have experience analyzing and interpreting technical and design requirements, designing software strategies, and creating code. Students will develop extensive knowledge of software version control procedures and systems, and management of software development.

The department will also host a number of research opportunities in the area of software development to meet real world goals and functions. This can help in the development of advanced technology and artificially intelligent systems.

C++ language as a problem-solving tool

High-level, object-oriented language programming using JAVA

Creation of JAVA applets for internet usage

Environmental Engineering Lab

TECH 253

DEPARTMENT OF ENGINEERING

The students receive instruction about microorganisms, bacterial morphology, communicable diseases (air- and water-borne), water quality, pollution control, and solid waste management.

Students will be ready for the work environment, because of their familiarity with laboratory routines and application of theory to practical experiences. Students will be able to apply the basic principles of hydrology and hydrometeorology, planning and management of water resources, water quantity and quality control, control of water flow to avoid damages, and water resource regulation.

Students can use the equipment for experimental research on engineering problems and develop new scientific approaches to solving environmental management problems facing the world.

Waste Water Treatment

Solid Waste Management

Microbiology

Sanitary Chemistry

Environmental Regulations

Flight Simulator Lab

TECH 156

DEPARTMENT OF AVIATION SCIENCE AND TECHNOLOGY

The Aviation Science and Technology Flight Lab is equipped with 8 Flight Desktop Simulators, 2 Fixed Training Devices (FRASCA'S), and a Fidelity Full Motion Simulator.

The primary purpose of the flight lab is to give students hands-on experience of what goes on in the cockpit of an aircraft, and to understand the basic fundamentals of flight. The courses offered pertaining to flight are Introduction to Flight, Private Pilot Flight, and Private Pilot Ground. These are introductory courses designed for familiarization with flight instruments, how they work and what information they provide to the pilot.

The training given in the flight lab will enhance students' knowledge of aircraft and their operating procedures. Should a student go on to pursue taking flying lessons, the student will be familiar with an aircraft and its parts as well as the instruments and how they operate. Currently there are ten graduates of the Aviation Science and Technology department that have become pilots, seven of which fly for Continental/United Airlines, one who is a pilot for Southwest Airlines, and two who are flight instructors.

Geotechnical/Material Testing Lab

TECH 152

DEPARTMENT OF ENGINEERING

The Geotechnical lab is used to test the structural properties of concretes, grouts, and composite materials. Tests are done to determine the soil and rock properties under both static and dynamic loading conditions. The lab has equipment to perform a variety of tests including:

Moisture Content

Atterberg Limits

Gradation Tests

Compaction and Permeability

Shear Strength

pH tests, Tri-axial tests, and Specific gravity

Concrete and Soil Testing

Work done in this lab will allow students to understand the theoretical and empirical principles of soil engineering. Subject areas covered include geological formations of natural soils, soil sampling, and classification. Soil properties of major engineering significance will be studied that include the characteristics of water flow through soil, consolidation settlement and shear strength.

Upon completion students will be able to identify soil categories, recognize solid composition, calculate soil properties, complete the solid compaction process, and calculate stresses in soil mass due to external and internal loads. Students will also be able to calculate settlements based on varying load and soil conditions. Students will develop a good understanding of shear strength of soils and characteristics of failure planes. All skills and theories learned in the geotechnical lab may be applied in the workplace.

Research is conducted in soil testing, soil modeling, numerical analyses, slope stability including progressive failure, analytical methods in geotechnical design, and geo-environmental engineering. Research may be done to provide insight into the interaction and performance of earth structures, bearing failures and settlement damage. There are opportunities to collaborate with government and private organizations to better predict geotechnical performance.

Soil testing

Soil modeling

Numerical analyses

Slope stability including progressive failure

Analytical methods in geotechnical design

Geo-environmental engineering

High Performance Computing Lab

TECH 138

DEPARTMENT OF PHYSICS

The High Performance Computing Center (HPCC) and Laboratory serves two important student communities. Computer Science majors learn how to assemble, set up, run and administer "state-of-the-art" computer equipment. Students within the core STEM disciplines such as physics, engineering, mathematics, and chemistry learn how to write parallel programming codes able to tackle challenging problems requiring extensive computational analysis, simulations, and visualizations (including 3D) critical to basic physics research (i.e. many body physics, materials research, bio-physics, quantum field theory, fluid dynamics, cosmology, etc.) and applied research (i.e. geophysics, seismology, meteorology, engineering, tomography, etc.).

The HPCC is hosted in a 672 square feet data center room; and powered by a 205 Volt circuit with a total deliverable power of 88 kWatts. It is cooled by three 20-ton AC units and it has a Sapphire fire protection system.

The HPCC cluster has 54 compute nodes with dual quad-core and 12-way cores Intel Xeon hyper-threaded processors, amassing a total of 944 cores, capable of running 944 independent computing threads. The total RAM memory of the cluster is 892 GB and the total storage capacity is 30 TB, which includes local hard drive space and three NAS storage units.

The cluster is accessible through a front node and a secondary front end. All nodes communicate through a 1Gb management network and also a high-speed, low-latency cupper 10 Gb production network. Management network is served by 3 Cisco switches, while the production network is served by 2 high performance Arista switches.

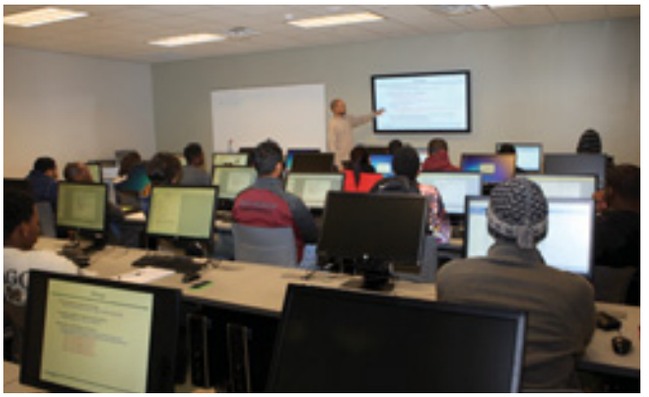
The cluster is administered centrally by the cluster management software Rocks and is instrumented by a variety of software stacks, compilers (C, Fortran, C++), communication libraries (MPI, OpenMP, Condor), and domain specific software like R, Mathematica, Matlab, Comsol and MrBayes. The peak performance of the cluster, as measured by Linpack benchmarks, is 1.75 TFlops. The cluster will be extended in the Spring of 2014 with 8 new "super-node" units based on an architecture that includes 4 Intel Xeon processors and 4 Intel Xeon Phi Co-processors, with the goal of maximizing the computing density for each node and reducing the power consumption per flop. The theoretical performance for each new node is estimated to be 4 TFlops.

Initial funding for the HPCC is made possible through awards from the National Science Foundation and the Department of Defense. Both student communities are positively impacted in their respective areas with regards to employment prospects requiring High Performance Computing experience.

Computer Science majors learn UNIX operating system and basic system administration skills, including managing SQL databases. These skills are transferable and in demand in the workforce market. Within the greater Houston metropolitan area, energy companies place high demands on students with HPC skills and experience.

Integrated Development Environment Lab TECH 330

DEPARTMENT OF COMPUTER SCIENCE



The Integrated Development Environment (IDE)Lab is designed to teach students how real-world problems can be solved using computer programming languages. Concepts and techniques covered include:

Data Representation and Number Systems

Basic Components of Computer Systems

Problem Solving Strategies

Algorithms and Pseudo Code

Introduction to Programming Languages

Introduction to Operating systems

JAVA programming language

Object oriented programming methodologies using C++, JFLAP, Ruby-rail, Phytom, SWI-Prolog, Keil

The IDE Lab will provide an environment that allows developers to gain awareness of each others activities within the collaborative software development space. The purpose of Collide is to allow software developers/collaborators a view of highly compact visualizations of each others actions on the source code artifacts which they are working on. Some possible applications of Collide include any software development project made up of two or more developers although we do not have to limit the scope to more than one developer as a fair bit of the information provided by Collide would be useful to single developer projects as well.

The mission of this IDE Lab is to explore, design, develop, and study reliable, scalable, self-managing systems. We have two goals: to engage in fundamental research that improves the state-of-the-art in IDE systems design; and to help IT professionals build and deploy compelling networking concepts. Research can span mobile and wireless networks; wide area internet systems and protocols; datacenter, enterprise, and home networks, network monitoring, inference, and diagnosis, and network performance improvements and analysis.

Low Field NMR Lab

TECH 232

DEPARTMENT OF PHYSICS

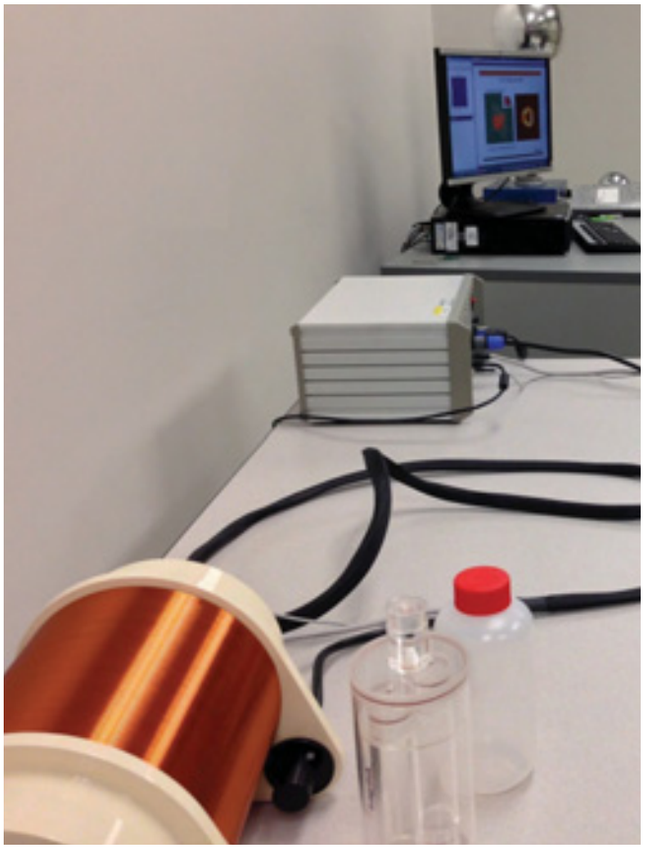
This is a research and student research training laboratory, emphasizing ongoing departmental research capabilities in noise filtering, atomic physics, and medical physics based research. Students learn modern Nuclear Magnetic Resonance (NMR) techniques which require an understanding of the underlying quantum physics associated with the spinning of atomic nuclei in an ambient, static, magnetic field and the spectrum of the electromagnetic radiation given off by these excitations. NMR is an important physical process with many applications including nuclear waste disposal and cancer detection in soft tissues. In the second case, Magnetic Resonance Imaging (MRI) is the conventional terminology encountered by many in cancer detection protocols. The NMR lab is equipped with the following equipment:

Earth field Terranova MRI system

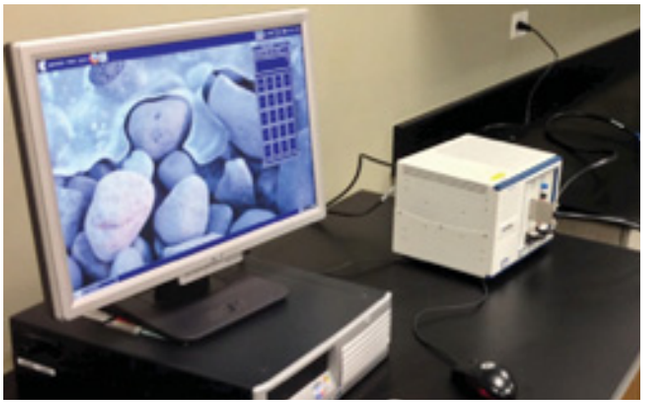
Low field NMR spectrometer

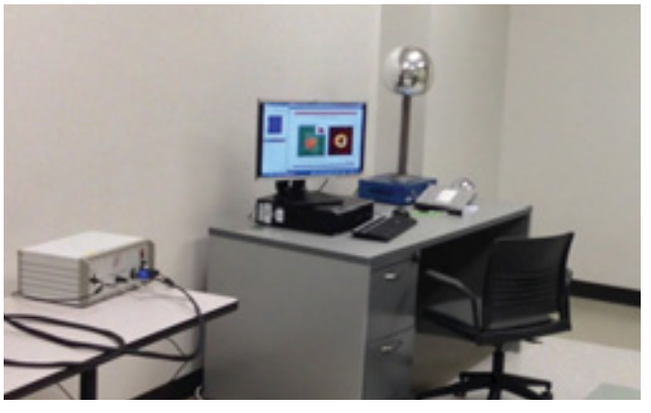
National Instruments Data Acquisition Instrument

A typical experiment involves probe preparation, field configuration, pulse design, data acquisition and data processing. Students will become familiar with contemporary electronics and digital signal and image processing. Participating students will also learn how to do research as part of a team, each contributing a particular skill. The ultimate objective of the underlying research is to develop more cost effective techniques, requiring low level magnetic fields, for effective cancer detection.



Students working in LF-NMR will become familiar with principles of operation of modern medical instruments. The training received in operating laboratory instruments provides an advantage in the workforce marketplace for students that choose a career in the medical field. Texas Medical Center, the largest medical center in the world, is located one mile from the TSU campus and offers a variety of employment opportunities for students with this training.





Maritime Transportation Lab

TECH 266

DEPARTMENT OF TRANSPORTATION STUDIES

In the Maritime Transportation Lab students will learn about various aspects of the maritime industry, specifically the three national priorities of logistics, security, and the environment that our program focuses on. This education includes use of state-of-the-art computers and software germane to the maritime industry. The 30 computers in the laboratory will allow students to learn through instructional class time, independent study, and research.

The Maritime Transportation Lab is also the location of the annual Summer Maritime Academy, a program for high school juniors and seniors designed to introduce students to the maritime industry.

According to recent studies, the Maritime industry is predicted to grow by 16% by the year 2016. This growth is fueled by the expansion of the Panama Canal and the retiring of the "baby boomer" workforce in the maritime industry. Training in the Maritime Transportation Management and Security curriculum will improve students' chances of employment after graduation in the industry because students will be training in an industry that is poised for growth in the near future.

The Maritime Transportation Laboratory will contribute towards enhancing research capabilities and improve funding opportunities for the Department of Transportation Studies by: 1) giving students access to state-of-the-art computers and technology to conduct research in the maritime industry, specifically in the national priorities of logistics, security, and the environment; and 2) providing the department with the technical resources to pursue funding opportunities that propose cutting edge and state-of-the-art research in the maritime industry.

Medical and Nuclear Physics Lab

TECH 235

DEPARTMENT OF PHYSICS

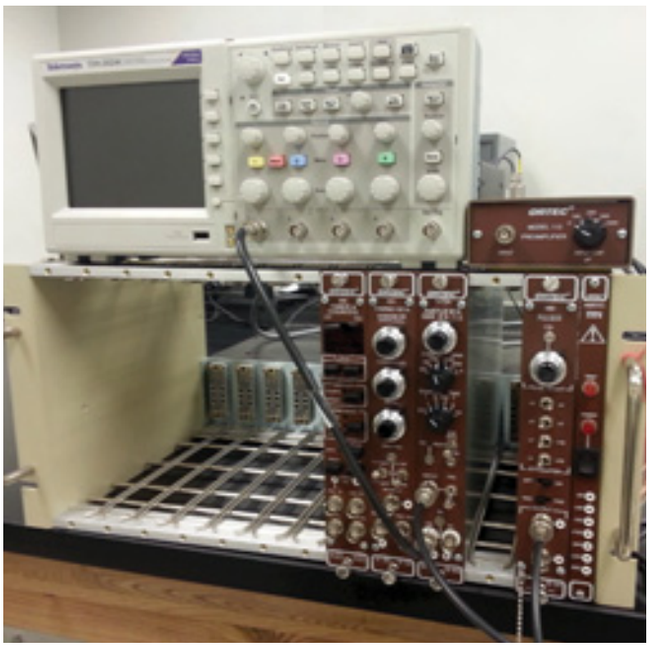
The Medical/Health - Nuclear Physics Laboratory is a research and student research training facility for developing and applying new techniques for effective monitoring of safe radiation levels affecting living organisms in many workplace environments including nuclear power plants, medical diagnostic and treatment facilities, food processing plants, homeland security, etc.

This Laboratory is concerned with basic and applied research in nuclear physics. The "applied" thrust pertains to understanding related issues in the context of medically related, nuclear physics based, diagnostics and therapies impacting diseases; and understanding the radiation thresholds in various workplace settings impacting living organisms and the environment.

Selected students will participate in fundamental research impacting all three areas as specified above. Besides mastering the basic dosimetry and radiation detection skills developed within the curriculum, participating students will apply these skills in the process of basic and applied research. Additional capabilities in Monte Carlo simulation studies in nuclear medicine, etc., will also be developed.

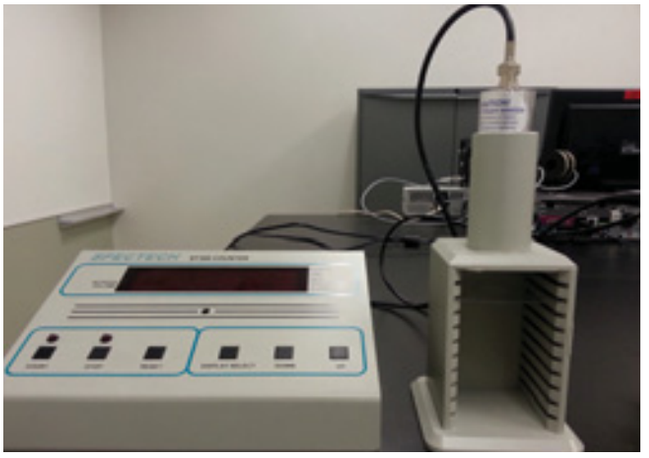
The objective is to develop students that can pursue these studies at a higher level, eventually transitioning into professionals in all the diverse areas where nuclear and radiation safety and treatments are vital. The advanced training received by selected students, developed within the context of performing basic and applied research in medical/health – nuclear physics, will produce uniquely trained students able to enter the workforce in diverse areas such as nuclear facilities, government laboratories, medical diagnostic and treatment facilities, food processing plants, space exploration, etc. These students may also pursue this advanced training as a stepping stone to careers as oncologists, radiation therapists, etc., within the medical profession.

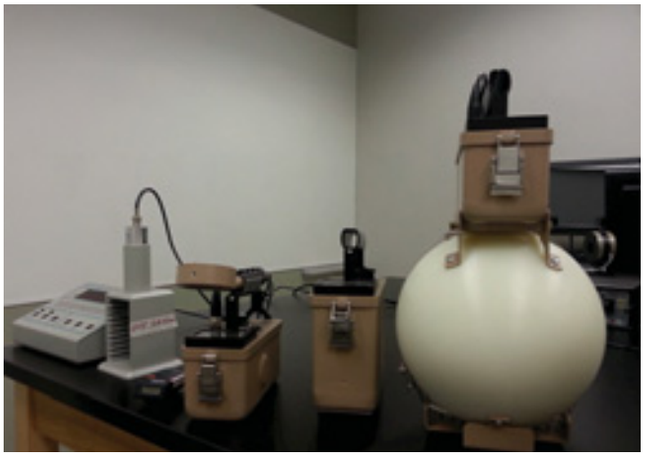
Houston hosts the world's largest medical facility, the Texas Medical Center, with tremendous employment opportunities for such students. Some of these students may also elect to pursue Ph. D. in nuclear physics, probing the smallest constituents of matter at the world's most elite high energy physics facilities. This lab is supported by Nuclear Regulatory Commission grant NRC-38-10-935.



Medical Health Physics Teaching Lab TECH 246

DEPARTMENT OF PHYSICS





The Medical and Nuclear Physics Teaching Lab builds upon the successful implementation of a Health Physics program at TSU begun in 2008. Health Physics concerns the understanding of nuclear processes as it affects safe working environments for living organisms (i.e. human beings in particular), within medical facilities, nuclear power plants, food processing centers, etc. Some of the equipment resources in this lab include:

Alpha Spectrometers

High Energy Resolution High Purity Germanium Detector

Geiger Mueller Counters

Lanthanum Bromide Scintillation Detector/Multichannel Analyzer

Wide Energy Neutron Detector

Survey Meters (Ion Chamber, Geiger Mueller, Neutron Detector)

Well Detector

Proportional Counter

Nuclear Instrumentation Bins and Modules

Gamma Spectroscopy System

Students enrolled in the traditional health physics program at TSU take several semesters of laboratory classes, which focus on unique hands-on experiments involving various radiation detection apparatuses, analyses, and techniques. In the first laboratory component, students learn how to use a Geiger-Mueller system to measure radiation emitted for various radionuclide species. In the second installment of the laboratory sequence, students learn how to use a sodium iodide detector system to measure spectroscopic signatures from gamma-emitting radioisotopes. The final course in this sequence is a nuclear electronics laboratory, in which students learn fundamental signal pulse analysis using standard instrumentation commonly employed in nuclear and radiation physics.

Given that Houston hosts the world's largest Medical Consortium: The Texas Medical Center, it is natural to expand upon the proven Health Physics capabilities into Medical Physics. This concerns the understanding of nuclear physics as applied to medical diagnosis and treatment for illnesses such as cancer. To this extent, the Medical/Health – Nuclear Physics Teaching Laboratory will also expand into this area. TSU-Physics has produced exceptional students that are currently junior radiation officers at the MD Anderson Cancer Center, pursuing advanced degrees at Texas A&M University – College Station, and at the University of Texas at Austin.

Funding provided by grants from the Nuclear Regulatory Commission, NRC-38-07-495.

Micro Processing Lab

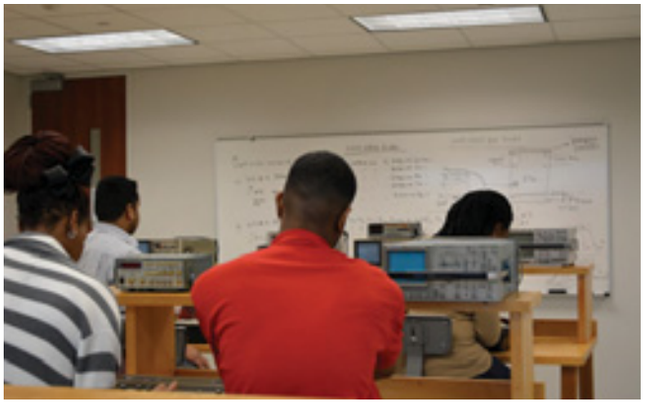
TECH 252

DEPARTMENT OF ENGINEERING

In this lab students are introduced to microprocessor hardware and software, including microprocessor principles, machine language programming, and input/output functions/timing. Students learn input/output operations, bus systems, subroutine and control signals, utilize micro assemblers to write floating point mathematical routines, learn special purpose language, and generate re-locatable code.

Students will have familiarity with low power electronics design, gain strong analysis skills, and an understanding of test development. Students will gain experience with different applications of Six Sigma development methods, Concept Engineering, Robust Characterization (P-Diagram), and Capability Analysis. Students will develop the ability to work collaboratively in a team environment.

The department will now be able to host a number of research opportunities in the area of software development to meet real world goals and functions. This can help in the development of advanced technology and artificially intelligent systems.



Mini TranStar Lab

TECH 155

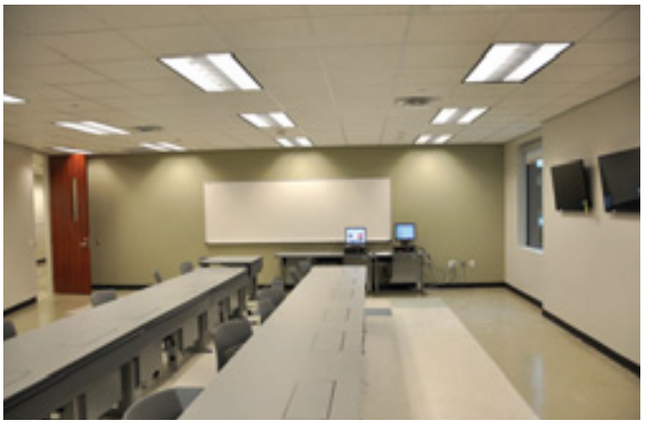
DEPARTMENT OF TRANSPORTATION STUDIES

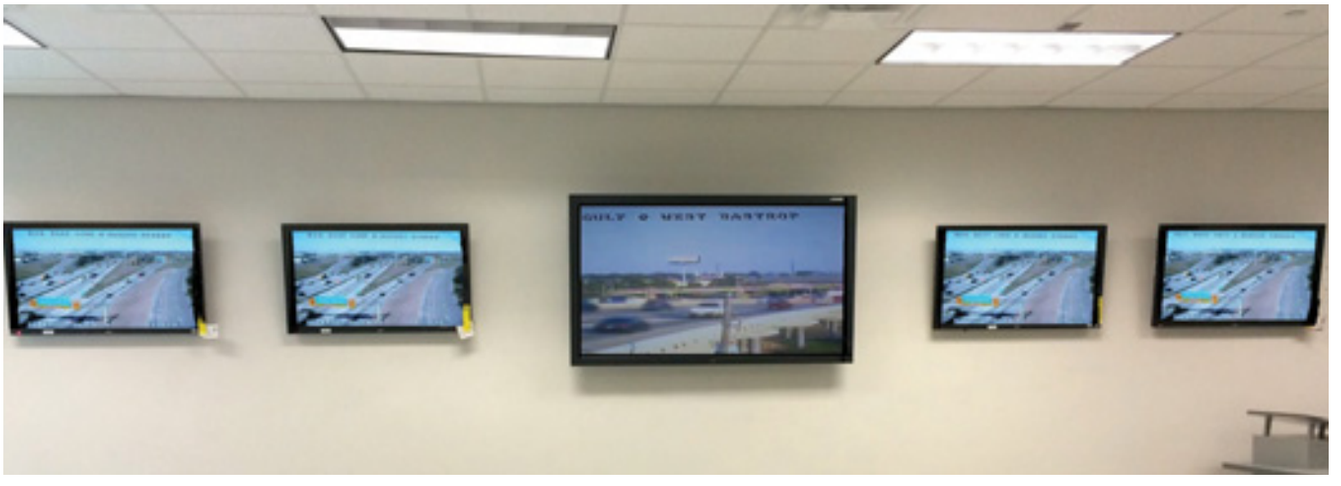
The Mini-TranStar lab in the Department of Transportation Studies was established in 2006 according to an agreement between TSU and Texas Department of Transportation, which allows TSU to access all the real time Closed Circuit Television (CCTV) traffic videos and speed data that are currently available in Houston Traffic Management Center, TranStar.

This lab is equipped with an exclusive internet connection between the Houston TranStar and the TSU lab. In the lab, there are five large LCD monitors and a couple of computers for displaying, selecting, recording, and analyzing traffic video images. The main function of this lab is to provide a surveillance of real-time traffic at any location on Houston freeways. The Mini-TranStar Lab is used for the courses TMGT 810, TMGT 812, and TMGT 862.

Traffic management centers deploy traffic management strategies to reduce congestion and coordinate state and local authorities during daily traffic or special events and emergencies. Accessibility of a mini traffic management center in the College and experience with the equipment in this lab provide the students with better credentials when they apply for jobs in the area of traffic management and operations.

The Mini-TranStar Lab combines the use of a research lab with a real-world Traffic Management Center. The lab is equipped with a TrafficVision Traffic Management Center Remote unit which can process and analyze real-time or recorded traffic videos, and collect traffic related data from many locations on Houston freeways to support the research being done in transportation operation, safety, and security areas. This lab can maximize the efficiency and productivity of the research being done in the Department of Transportation Studies.





Multimedia Networking Lab

TECH 404

DEPARTMENT OF COMPUTER SCIENCE

The Lab provides the fundamental networking concepts and technologies focusing on both the conceptual and practical skills needed to understand basic networking, focusing on the fast emerging field of multimedia authoring and application development. It covers multimedia representation, storage, and communication. It provides the students with the basics of integrating audio, video, and textual sources into multimedia objects. Students will gain an understanding of the "layered" approach to networks and examine the OSI and TCP/IP layers in detail to understand their functions and services. It provides the underlying concepts and processes of the common Layer 2 switching protocols and technologies. It provides a comprehensive study of inter-networking as well as routing concepts and protocols to develop an understanding of how networks are linked together.

The second track, Bachelor of Science in Computer Science with Computer Networks Concentration, is for students who plan to have in-depth knowledge of today's rapidly growing field of Computer Networks. Once they graduate, students pursuing this track will be ready to apply for leading industry certificates such as the Cisco Certified Network Associate (CCNA) certificate which improves their competitiveness in today's challenging job market where networking is an essential ingredient of almost every business.

The mission of our networking paradigm is to explore, design, develop, and study reliable, scalable, self-managing networks and systems. We have two goals: to engage in fundamental research that improves the state-of-the-art in networked systems design; and to help IT professionals build and deploy compelling networking concepts. Research spans mobile and wireless networks; wide area internet systems and protocols; datacenter, enterprise and home networks, network monitoring, inference, diagnosis, and network performance improvements and analysis. Research can investigate new connectivity paradigms emphasizing scenario-based research with rapid prototyping so that researchers can experiment with actual systems.

Multipurpose Engineering Computer Lab TECH 258

DEPARTMENT OF ENGINEERING

Civil Engineering Design and Documentation Solution

Construction Project Administration

Engineering Plan and Specification Development

Computer Engineering Projects

Students will utilize computer programs such as AutoCAD and Microstation as tools in computer, and civil engineering design and documentation solution that supports Building Information Modeling workflows.

There will also be use of other relevant software to explore structures with emphasis on both the analytical and graphical approaches to trusses and building frames, design in steel of tension members, beams, columns, welded and bolted connections; eccentrically loaded and moment resistant joints; and plate girders.

Students will be able to oversee and participate in construction project administration; assist in overseeing engineering plan and specification development, and ensure compliance with design specifications, codes, and District and other regulatory standards. Their training in AutoCAD will allow them to better understand project performance, maintain more consistent data and processes, and respond faster to change.

The department will now be able to host a number of research opportunities in the area of computer engineering and civil engineering design and planning necessary to meet the changes in global demands.

Network Lab

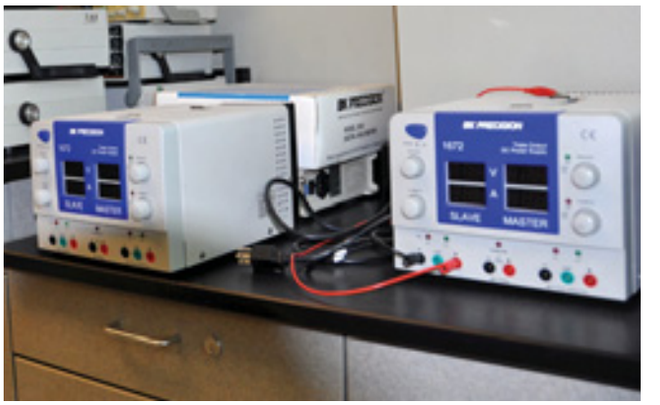
TECH 262

DEPARTMENT OF ENGINEERING

Students will conduct experiments where they will conduct, test and debug hardware and software components for computer networks. Students will study and test the standard protocols of LANs and WANs. Students will also analyze the design and operation of micro computer networks, including inter-networking, routers, and network management.

From classroom and lab instruction students will be able to perform duties necessary to manage assigned departmental computing and network resources including technology assessment and planning, systems analysis and design, evaluation and establishment of computing and computer training standards. Students will learn how to coordinate and provides expert technical consultation for the selection, evaluation, purchase, and installation of computing hardware, software, and supplies.

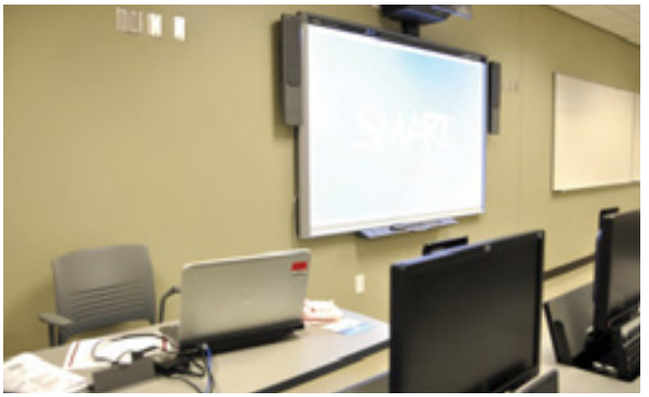
The department will now be able to host a number of research opportunities in the area of software development to meet real world goals and functions. This can help in the development of advanced technology and artificially intelligent systems.

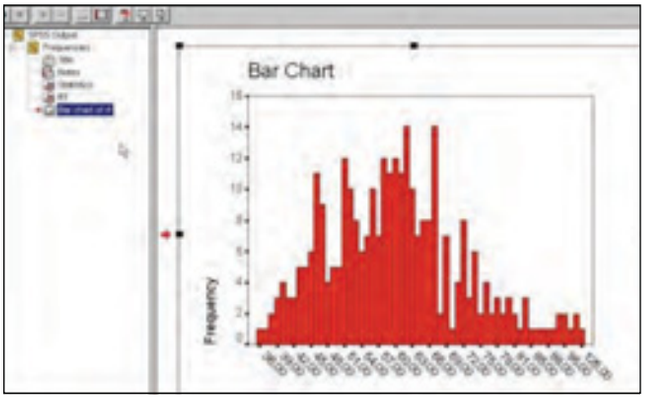


Special Computer Lab

TECH 261

DEPARTMENT OF TRANSPORTATION STUDIES





The special computer lab in the Department of Transportation Studies is equipped with 26 computers installed with a variety of transportation software, including transportation planning software (CUBE, TRANSCAD, etc.), traffic statistical analysis software (Microsoft Excel, Microsoft Access, SPSS, SAS, etc.), and Geographic Information System (GIS) software (ArcGIS, etc.). Students will learn the use of these softwares through a series of classes, including TMGT 815, TMGT 882, TMGT 850, TMGT 830, TMGT 811, TMGT 823 and TMGT 812. Regular trainings or workshops are also held in this lab by faculty or invited experts.

Students will gain experience and skills in the following areas: 1) traffic demand forecasting. With the use of transportation planning software, e.g. CUBE, students can estimate the future travel demand and the impacts of alternative transportation policies and improvements, 2) transportation system design and data analysis. With the use of Geographic Information System (GIS) software, e.g. ArcGIS and data analysis software, e.g. SPSS, students can spatially analyze the performance of different transposition designs and develop mathematical models to predict traffic conditions. Through these experiences, students will gain marketable skills to facilitate placement in both academic and industrial fields after their graduation.

Most federal or state funded transportation projects include tasks that require data analysis, traffic demand forecasting, or ArcGIS based system design and analysis. By using the state-of-the-art softwares installed in this lab, TSU researchers could conduct research in the fields of travel demand forecasting, air quality analysis, public transit systems, transportation design and analysis, Intelligent Transportation Systems (ITS), and transportation planning and management. This lab significantly increases our research capabilities and improves the funding opportunities for TSU.

Transportation Planning

Traffic Statistical Analysis

Geographical Information Systems

Traffic Signal Lab

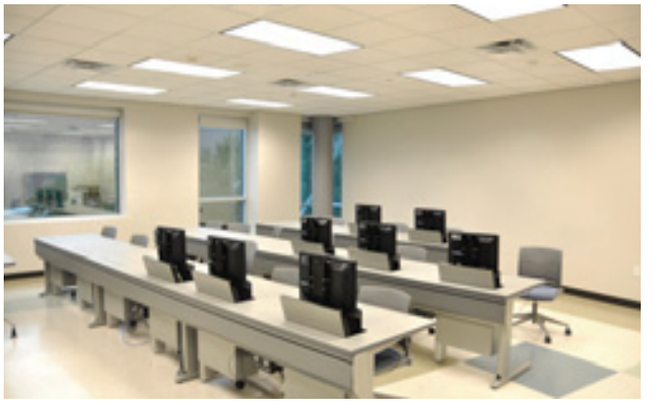
TECH 250

DEPARTMENT OF TRANSPORTATION STUDIES

The Traffic Signal Lab is a state-of-the-art laboratory dedicated to education, training, and research for traffic signal operations. The lab includes a TS-2 Type 2 traffic signal cabinet, a NEMA cabinet display, several ATC NEMA traffic signal controllers, and other traffic signal related equipment. The Traffic Signal Lab will be used for the course TMGT 865, and it will familiarize students with the design and interpretation of traffic signal plans, the components of a traffic signal system, and advanced traffic signal controls.

This lab provides us the capability of conducting full intersection signal control demonstrations and tests. The unique environment of the Traffic Signal Lab exposes students to the complexities of setting up and maintaining traffic signal controllers, conflict monitors, load switches, detection and communication systems on traffic signal cabinets; and as a result, the students will have hands-on experience working with traffic signal related equipment. Having those experiences will provide the students better opportunities to apply for the jobs in all areas of traffic operations. This lab can be used for educating and training of signal technicians and traffic engineers in the public and private sectors.

The Traffic Signal Lab has been also established to support research in the area of traffic operations. The lab employs Controller Interface Device (CID) units linking the actual traffic signal controllers with traffic micro-simulation software (hardware in-the-loop simulation, HILS). This system provides the capability of designing and testing optimized signal control strategies in a virtual environment. It allows for the realistic evaluation of controller operations and traffic control strategies without disturbing real traffic flow. It is an essential research asset that will enhance the research productivity and funding opportunities for TSU.



Traffic Simulation Lab

TECH 217

DEPARTMENT OF TRANSPORTATION STUDIES

A Traffic simulation lab was established in the Department of Transportation Studies to provide students with opportunities to learn the most up-to-date traffic simulation software, e.g., CORSIM, VISSIM, SIMTRAFFIC, PARAMICS, DynaSIM, TRANSIMS, etc. There are 10 computers equipped with advanced Traffic simulation software. Students can utilize this software to build up roadway networks, design different traffic scenarios, and run traffic simulations to test or validate the performance of different roadway design and traffic control alternatives. Regular trainings or workshops will be held in the lab by faculty or invited experts.

Transportation professionals have used traffic simulation as an important tool for testing different traffic design alternatives in a realistic and highly detailed manner before field implementation. Simulations are widely used in the industrial and academic fields. With the state-of-the-art simulation software available in this traffic simulation lab, students will acquire important skills related to the use of software, which could significantly increase their employment potential in the transportation related public and private sectors.

This laboratory allows TSU researchers to conduct advanced transportation researches including 1) development, evaluation, and fine-tuning of signal priority logic, 2) evaluation and optimization of traffic operations in a combined network of coordinated and actuated traffic signals, 3) easy comparison of design alternatives at intersections, roundabouts, and grade separated interchanges, 4) modeling and simulating flows of pedestrians, etc. The enhanced research capabilities for TSU researchers will be an advantage when applying for external funding.

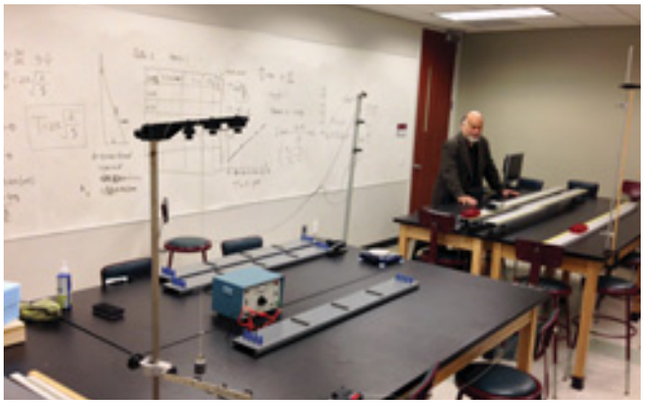
Undergraduate Physics Lab I

TECH 239

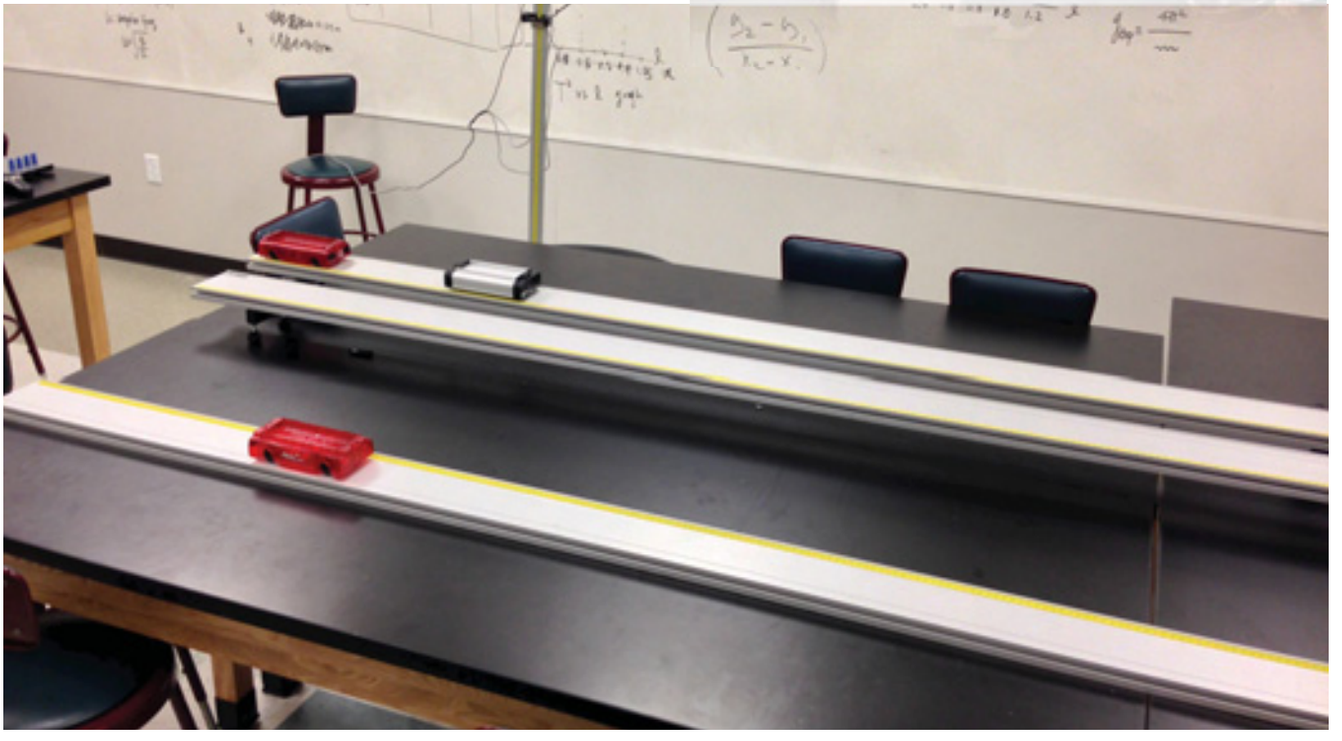
DEPARTMENT OF PHYSICS

All students pursuing careers in the STEM as well as non-STEM areas must take one of the three service physics courses: Physical Sciences (for non-STEM-majors), College Physics (I & II, consisting of a comprehensive overview of laws of physics, without using calculus), and University Physics (I & II). The latter involves the use of calculus, which is the natural mathematical language of physics.

In addition to the lectures, there are accompanying Labs for College Physics and University Physics. These labs are intended to reinforce basic physics concepts through a "hands-on" approach emphasizing the statistical theory of measurements, and experiencing, first-hand, many of the fundamental laws of Newtonian physics as it impacts mechanics and gravity. These labs introduce students to basic topics such as fluids, waves, and thermodynamics (heat).



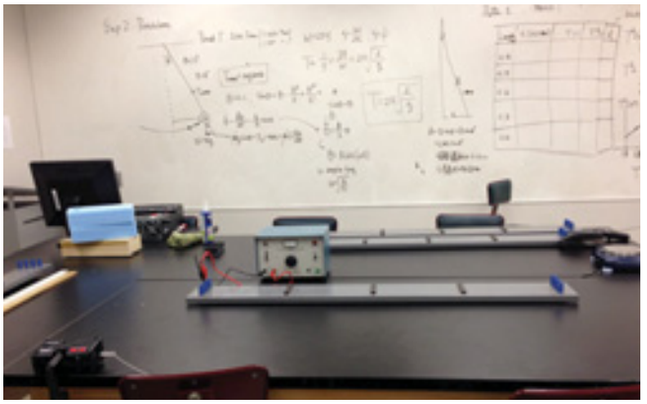
Mechanics and Gravity
Fluids
Waves
Thermodynamics (Heat)



Undergraduate Physics Lab II

TECH 241

DEPARTMENT OF PHYSICS



The more advanced Undergraduate Physics lab II introduces students to basic topics such as electricity and magnetism, optics, and modern physics. Students acquire a basic understanding of all these areas through experiments designed to reinforce the lectures. All of these topics are indispensable to the careers pursued by the diverse body of professional interests represented in our students, both majors and non-majors. Students with these skills and knowledge are in high demand in many professions (health sciences, pharmacy, education, engineering, aeronautics, etc.).

These labs are the cornerstone of a student's immersion into, and understanding of, physics. These Labs will prepare students not only in the technical preparation of physics, but also in the scientific method of empirical research impacting all the sciences. Students will learn team work, sharpen their advanced mathematics skills (i.e. vectors, trigonometry, algebra, and statistical analysis), and develop critical thinking skills based on direct interaction with experiments.

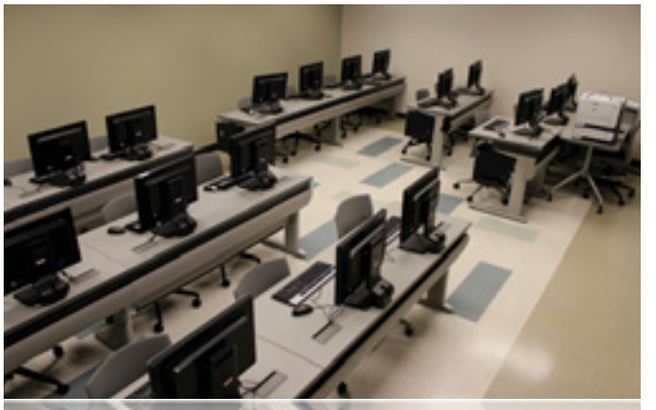
Electricity and Magnetism
Optics
Modern Physics

Unix Lab

TECH 415

DEPARTMENT OF COMPUTER SCIENCE

The main focus of this lab is Dual-Boot with UNIX/ Windows. The operating system UNIX and the many different versions of UNIX are studied. Although they share common similarities, the most popular varieties of UNIX are Sun Solaris, GNU/ Linux, and MacOSX. The students are introduced to the function, internal data structures, and operations of operating systems and their associated file systems. Students are introduced to a graphical user interface (GUI) similar to Microsoft Windows which provides an easy to use environment.

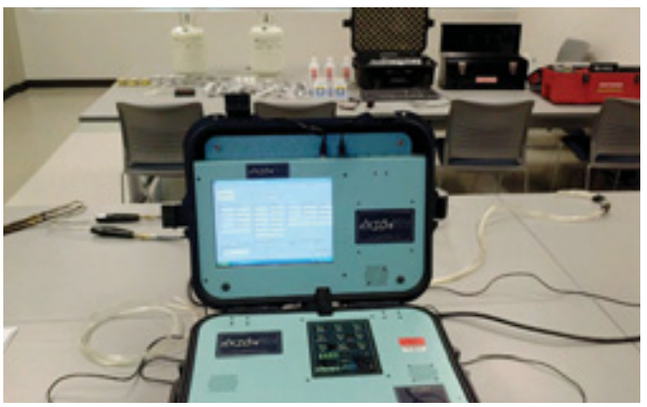


UNIX was created in the 1970s by AT&T's Bell Laboratories and has gone through design evolutions by both universities and companies. After more than 30 years of use, the UNIX operating system is still regarded as one of the most powerful, versatile, and flexible operating systems. Its popularity hinges on its simplicity, open standards design, its ability to run on a wide variety of machines, and its portability.

Vehicle Emission Lab

TECH 264

DEPARTMENT OF TRANSPORTATION STUDIES



The advanced Portable Emission Measurement System (PEMS) – Axion in the Department of Transportation Studies, facilitates measurement of second-by-second real-world fuel consumption, Greenhouse Gas (GHG) and pollutant emissions from a variety of on-road vehicles and non-road equipments such as yard tractors, construction machinery, forklifts, locomotives, small aircraft, etc.

Students will be trained to use the PEMS equipment for collecting vehicle emissions in field studies. This is a very practical training with interdisciplinary skills required.

Students will receive interdisciplinary training, not only in transportation operations and management, but also in vehicle emissions testing and modeling, and environment technology and science. Due to the nature of the training, students will receive some basic knowledge regarding vehicle manufacturing. Students trained in this lab will be more competitive in finding jobs in even wider areas such as transportation engineering, environmental protection agencies and companies, and vehicle engineering.

The vehicle emission testing equipment, PEMS is a state-of-the-art device that can measure real time vehicle emissions and fuel consumption. Axion is composed of five components: the dual five-gas analyzer, the Particulate Matter (PM) monitor, the engine data obtaining subsystem, the Global Positioning System (GPS), and the on-board computer. The PEMS equipment is a very convenient and powerful tool for conducting advanced transportation and environmental research in evaluating the impacts of adopting environment-friendly traffic management strategies to reduce poor air quality and energy consumption. This equipment is a great asset for TSU and will support efforts to win more external funding.

Web Development Lab

TECH 334

DEPARTMENT OF COMPUTER SCIENCE

This labs main focus is the study of Web development at the back-end of the website where the programming and interactions are focused on the pages, the study of concepts, technologies, and tools required for developing multi-tiered enterprise-level Web applications, the fundamental architectural elements of programming web sites that produce content dynamically, as well as the database connectivity options, distributed object technologies, n-tier client/server applications architecture, and security issues. The students focus on how a site works and how the customers get things done on it. Students are introduced to World Wide Web applications and design, including Web scripting languages and HTML editors. Students are able to learn how to program CGI and scripts like PHP. They understand how web forms work and can keep a site running effectively.

The Web Development Lab will offer a full range of professional web services, including:

Site Design & Redesign

Usability Testing

Accessibility Consulting

Site Maintenance and Updating

TSU Template Conversion

Our professional artists and programmers collaborate to deliver stunning websites that meet the individual requirements of our clients. Whether you're looking for a traditional TSU look with a few tweaks, or a highly creative identity, the Web Lab is here to help build a site that is both visually compelling, and in compliance with all University Web Standards.

Web Development Laboratories tend to be scientific areas in the science industry which are used to appoint, carry through, or address assessment results.

Wireless Sensor Networks Research Lab TECH 336

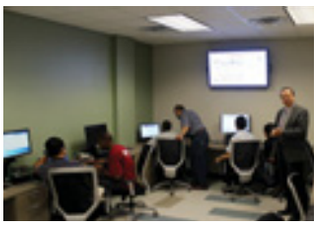
DEPARTMENT OF COMPUTER SCIENCE

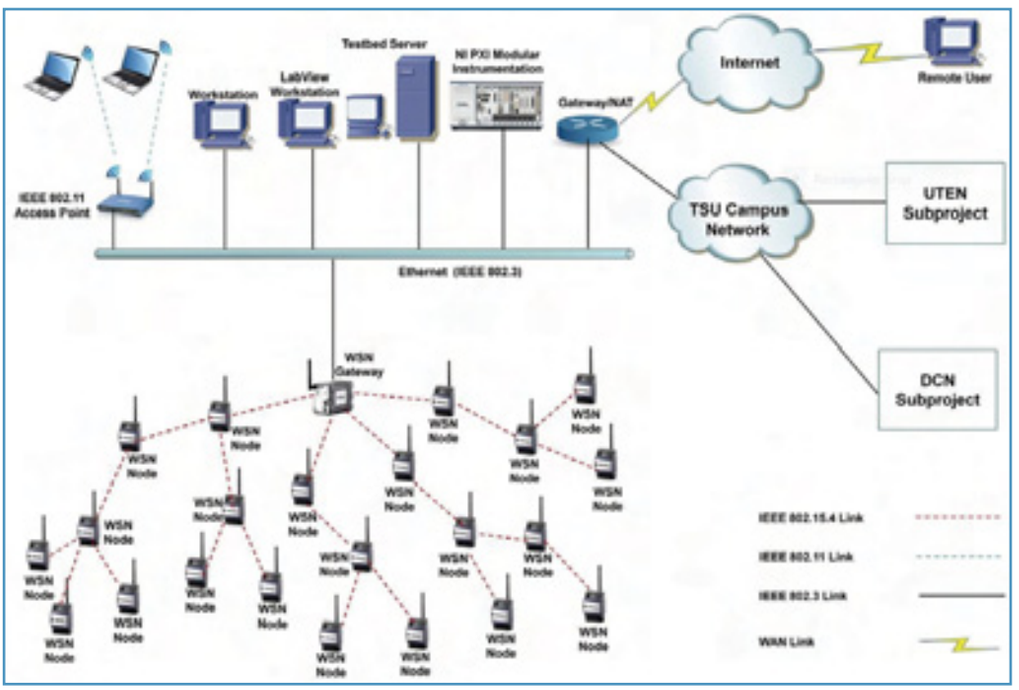
The Wireless Sensor Networks (WSN) Research Lab hosts a state-of-the-art experimental research facility for WSN. The test-bed facility is used for the prototyping and evaluation of developed protocol solutions and serves as a basis for the development of novel mobile context aware services and applications. The test-bed consists of wireless sensor and actuator nodes that can be organized in different network topologies and individually configured for various experiments and uses the backbone infrastructure of the Wireless Network Test-bed.

The WSN Research Lab conducts research mainly on the problems at the network and application layer of various wireless ad hoc networks including smart grid communication networks (SGCNs), wireless mesh networks (WMNs), wireless multimedia sensor networks (WMSNs), online-social networks (OSNs) and underwater acoustic sensor networks (UWSNs). Specifically, researchers are working on energy efficiency, security, privacy, routing, graph mining, key management, connectivity, node placement, clustering, coverage, fault-tolerance, and QoS problems in these networks.

Wireless Sensor Networks provide a new paradigm for sensing and disseminating information from various environments, with the potential to serve many and diverse applications. Current WSNs typically communicate directly with a centralized controller or satellite. Students trained in this Lab will know how to make use of sensor related technology to make the world work as it does. Employment in the WSN technology field includes jobs such as Wireless Communication Technician, Sensor Networking Technician, Data Communications Technician, Systems Engineer, Website Administrator, Unix System Administrator, Java programmer, Database Administrator, Database developer, Computer Artist, Website Coder, Data Management Analyst just to name a few.

WSNs have garnered a considerable amount of attention over last half a decade, primarily due to the unique applications they enable. However, there is an important constraint on the operation of such networks - the energy source at sensors. Except for environments where an energy source can be harnessed in a low cost manner, the very survivability of WSNs depends upon how energy efficient the sensors operate while performing their required functions.





COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY ADMINISTRATION

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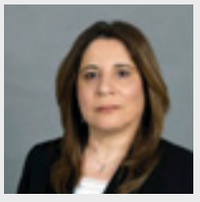

Nadereh Jahedmotlagh
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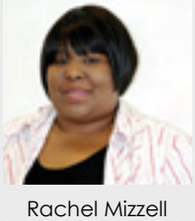
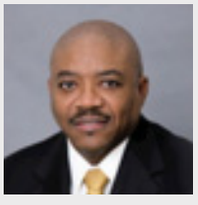
ENVIRONMENTAL & INTERDISCIPLINARY SC.

Shishir Shishodia
Associate Professor and Interim Chair



Rachel Mizzell
Administrative Assistant

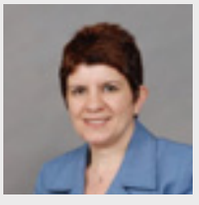
INDUSTRIAL TECHNOLOGY



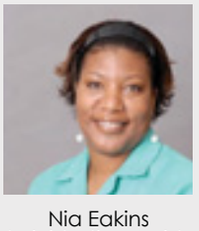
Jessie E. Horner
Associate Professor and Interim Chair

Lulueua A. Nasser
Administrative Assistant

MATHEMATICS

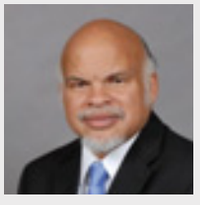


A. Serpil Saydam
Associate Professor and Chair

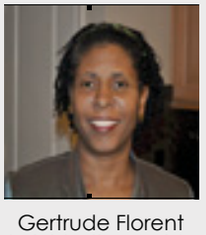


Nia Eakins
Administrative Assistant

PHYSICS

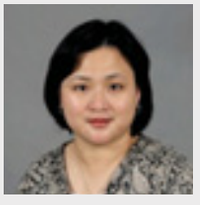


Carlos Handy
Professor and Chair



Gertrude Florent
Administrative Assistant

TRANSPORTATION STUDIES



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