

COLLEGE OF SCIENCES AND ENGINEERING

COLLEGE HONORS

The College of Sciences and Engineering designates certain of its outstanding students as Honors students and provides the opportunity for advanced study under close faculty supervision.

Selection of students for admission to the College Honors Program is based on: 1) the student's academic performance, and 2) recommendation by the faculty of the student's major discipline. To be eligible for the program, students must have a minimum grade-point average of 3.00 overall at UTSA and a minimum grade-point average of 3.00 in their major at UTSA. The minimum grade-point averages must be maintained for students to receive the approval of the College Honors Committee and the discipline faculty. Students admitted to the Honors program are expected to enroll in the appropriate Honors Research course during the final two semesters in residence. The completed research paper must be approved by the supervising faculty sponsor and another college faculty member. Students interested in this program should contact their faculty advisors for additional information.

DIVISION OF EARTH AND PHYSICAL SCIENCES

The degree programs offered by this Division reflect its policy of offering the opportunity for a comprehensive education of the highest quality, individualized to the needs and interests of the student. Completion of a core curriculum allows the student to apply for entry into one of several highly specialized areas in Chemistry, Geology, or Physics. A student who has majored in any of these degree programs is eligible to apply for positions in industry and government as well as apply for entry into professional and graduate schools.

BACHELOR OF SCIENCE DEGREE IN CHEMISTRY

The Bachelor of Science Degree in Chemistry provides opportunities for preparation for careers in industry, government agencies, environmental studies, preprofessional programs, medical technology, and for graduate study in chemistry or other related fields.

The minimum number of semester hours required for this degree, including the 42 semester hours of General Education Requirements, is 133. All candidates for the degree must complete:

A. 47 semester hours of required courses in Chemistry.

- CHE 1103 Introductory Chemistry
- CHE 2003 Chemical Principles
- CHE 2012 Inorganic Qualitative and Quantitative Analysis
- CHE 2203 Organic Chemistry I
- CHE 2242 Organic Chemistry I Laboratory
- CHE 3003 Organic Chemistry II
- CHE 3022 Organic Chemistry II Laboratory
- CHE 3103 Analytical Chemistry
- CHE 3204 Physical Chemistry I
- CHE 3212 Physical Chemistry Laboratory
- CHE 3224 Physical Chemistry II

**Bachelor of Science Degree in Chemistry / 159
Chemistry**

- CHE 3232 Instrumental Analysis
CHE 4243 Organic Chemistry III
CHE 4253 Physical Chemistry III
CHE 4263 Inorganic Chemistry
CHE 4923 Special Project in Chemistry or CHE 4913 Independent Study
CHE 4971 Proseminar (2 semester credit hours are required for the degree)
- B. 9 additional semester hours of approved *elective* Chemistry at the upper-division level are required.
- C. 26 semester hours of *support work* in Science and Mathematics.
1. Required courses are:
 - MAT 1214 Calculus I
 - MAT 1223 Calculus II
 - MAT 2213 Calculus III or CS 1723 Data Structures I
 - PHY 1904 Technical Physics I
 - PHY 1911 Technical Physics I Laboratory
 - PHY 1924 Technical Physics II
 - PHY 1931 Technical Physics II Laboratory
 2. 6 additional hours of *elective work* are required in courses in the College of Sciences and Engineering, as approved by the Advisor.
- D. Three (3) semester hours minimum in computer science.
- CS 1073 Introductory Computer Programming for Scientific Applications
or
CS 1713 Introduction to Computer Science and
CS 1711 Introduction to Computer Science Laboratory
- E. 6 semester hours of *electives*.

**COURSE DESCRIPTIONS
CHEMISTRY
(CHE)**

1003 General Chemistry for Allied Health Sciences

(3-0) 3 hours credit. Prerequisite: Concurrent enrollment in CHE 1111.

Introduction to atomic structure, chemical bonding, stoichiometry, states of matter, inorganic chemical reactions, acids and bases. For majors in occupational therapy, pre-nursing, and dental hygiene. May not be applied to a major in chemistry, biology, or medical technology.

1103 Introductory Chemistry

(3-0) 3 hours credit. Concurrent enrollment in CHE 1122 and MAT 1013 recommended.

An introduction to descriptive inorganic chemistry and atomic-molecular structure. Including such fundamental concepts as the periodic system of elements, valency, chemical bonding, reactions and reaction mechanisms, stoichiometry, equilibria, acids and bases, thermochemistry, molecular-kinetic theory, and states of matter.

1111 General Chemistry Laboratory for Allied Health Sciences

(0-4) 1 hour credit. Prerequisite: Concurrent enrollment: CHE 1003.

Introduction to chemical laboratory techniques. For majors in occupational therapy, pre-nursing, and dental hygiene. May not be applied to a major in chemistry, biology, or medical technology.

1122 Introductory Chemistry Laboratory Workshop

(1-4) 2 hours credit. Prerequisite or concurrent enrollment: CHE 1103.

An introduction to chemical problem solving and the basic operations of the chemical

laboratory; and a survey of inorganic chemical reactions. This course consists of problem sessions, lecture-demonstrations, and/or laboratory experience.

2003 Chemical Principles

(3-0) 3 hours credit. Prerequisite: CHE 1103. Primarily for science majors.

Elementary inorganic and physical chemistry: descriptive inorganic chemistry, coordination chemistry, solutions and electrolytes, redox processes, elementary thermodynamics, chemical kinetics, and elementary electrochemistry.

2012 Inorganic Qualitative and Quantitative Analysis

(1-5) 2 hours credit. Prerequisite or concurrent enrollment: CHE 2003.

Techniques of qualitative and quantitative chemical analysis, illustrated primarily via inorganic chemical systems and their reactions.

2103 Elementary Organic and Biochemistry

(3-0) 3 hours credit. Prerequisites: CHE 1003 and 1111. May not be applied to a major in chemistry.

A survey of the structures and reactions of some important functional groups of organic chemistry. The relationship of these functional groups to the chemistry of lipids, carbohydrates, nucleic acids and proteins.

2111 Organic and Biochemistry Laboratory

(0-4) 1 hour credit. Prerequisite or concurrent enrollment: CHE 2103. May not be applied to a major in chemistry.

Laboratory examination of the properties of some simple organic and biological chemicals; solubility, crystallization, organic reactions, titration, enzyme action, sugars and vitamins.

2203 Organic Chemistry I

(3-0) 3 hours credit. Prerequisites: CHE 2003 and 2012. Primarily for chemistry, pre-med and science majors.

An elementary study of structure, stereochemistry, reactions, and reaction mechanisms associated with organic compounds.

2242 Organic Chemistry I Laboratory

(1-5) 2 hours credit. Prerequisite or concurrent enrollment: CHE 2203.

Qualitative analysis and determination of the physical constants of organic compounds. Separation, identification and elementary synthesis of organic compounds. Laboratory techniques (crystallization, distillation, chromatographic) and spectroscopic techniques (IR, NMR, MS) are emphasized.

3003 Organic Chemistry II

(3-0) 3 hours credit. Prerequisite: CHE 2203; Prerequisite or concurrent enrollment: CHE 2242.

Continuing study of fundamentals of structure, reactions and reaction mechanisms of phosphorus and sulphur; poly-functional organic compounds. A continuation of CHE 2203.

3022 Organic Chemistry II Laboratory

(1-5) 2 hours credit. Prerequisite: CHE 2242. Prerequisite or concurrent enrollment: CHE 3003.

Quantitative and continuing qualitative study of organic reactions and molecular structure through functional group interactions and spectroscopic techniques. Simple and multi-step syntheses of organic compounds.

3103 Analytical Chemistry

(2-5) 3 hours credit. Prerequisites: CHE 2003 and 2012.

A detailed study of wet chemical and basic instrumental analysis including gravimetric, volumetric, and spectrophotometric determinations.

3204 Physical Chemistry I

(4-0) 4 hours credit. Prerequisites: CHE 2003, 2012, MAT 1223, PHY 1924, and 1931; at least one semester of organic chemistry is also recommended.

States of matter, gas laws, equations of state, inter-molecular interactions; thermodynamics and physical equilibria, elements of molecular-kinetic theory and statistical mechanics; physico-chemical properties of solutions, chemical equilibria, phase equilibria, and changes of state.

3212 Physical Chemistry Laboratory

(0-6) 2 hours credit. Prerequisite or concurrent enrollment: CHE 3204.

Experimental study of thermodynamics and electrochemistry, spectroscopy, and reaction kinetics.

3224 Physical Chemistry II

(4-0) 4 hours credit. Prerequisite: CHE 3204.

Chemical kinetics, electrolytes and electrochemistry, elements of quantum mechanics, chemical bonds, spectroscopy, and photo-chemistry. A continuation of CHE 3204.

3232 Instrumental Analysis

(0-6) 2 hours credit. Prerequisites or concurrent enrollment: CHE 3022, 3212, and 3224. Electrochemical methods; use of modern spectrometric and chromatographic instrumentation in separation, purification, and/or quantitative characterization of chemical systems.

4223 Advanced Biochemistry

(3-0) 3 hours credit. Prerequisites: BIO 3513, 3522 and CHE 3003, 3022.

Chemical aspects of regulation and control mechanisms; membrane-related phenomena; oxidative phosphorylation and photosynthesis; transport mechanisms; and contractility of muscle.

4231 Advanced Biochemistry Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: CHE 4223.

Applications of UV-visible and NMR spectroscopy, electrophoresis, gas chromatography, mass spectrometry and other physical techniques to biochemistry.

4243 Organic Chemistry III

(3-0) 3 hours credit. Prerequisites: CHE 3003 and 3022; CHE 3204 or consent of instructor.

Advanced mechanistic and synthetic aspects of organic reactions. Molecular rearrangements, organic molecular orbital theory and its application to pericyclic reactions. A continuation of CHE 3003.

4253 Physical Chemistry III

(3-0) 3 hours credit. Prerequisites: CHE 3003, 3224 and 3232; or consent of instructor.

Relations between structure of molecules and physico-chemical properties of gases, liquids and solids — quantum mechanical and statistico-thermodynamical approach.

4263 Inorganic Chemistry

(3-0) 3 hours credit. Prerequisite: CHE 3204.

A study of the elements and their periodic properties; acid-base theory, crystalline state, coordination chemistry, non-aqueous solvents and other advanced topics.

4373 Organic Spectral Studies

(3-0) 3 hours credit. Prerequisite: CHE 3022.

Identification of functional groups and the determination of the structure of compounds by spectral techniques including IR, NMR, mass spectroscopy and UV-Vis absorption spectroscopy; basic theory of spectral measurements with emphasis on practical applications.

4403 Chemistry of Heterocyclic Compounds

(3-0) 3 hours credit. Prerequisite: CHE 3003 or consent of instructor.

The chemistry of nitrogen, oxygen, and sulfur heterocycles. Five-membered and six-membered ring systems with one and more than one heteroatom. Applications in the field of synthetic drugs.

4603 Synthesis and Biosynthesis of Natural Products

(3-0) 3 hours credit. Prerequisite: CHE 4373, 4243, and/or BIO 3513 are recommended.

Comparison of chemical and biochemical formations and transformations for several classes of naturally occurring compounds such as steroids, terpenoids, alkaloids, and other natural products of chemical or biological importance.

4911-3 Independent Study

1-3 hours credit. Prerequisite: Permission in writing (form available).

Independent reading, research, discussion, and/or writing under the direction of a faculty

162 / Chemistry
Bachelor of Science Degree in Geology

member. For students needing specialized work. May be repeated for credit, but not more than 6 hours will apply to the bachelor's degree.

4923 Special Project in Chemistry

3 hours credit. Prerequisite: Consent of Division Director.

A special laboratory research or library readings project under the direction of a faculty member, resulting in a report, limited to students in their final year of undergraduate study.

4931-3 Internship in Applied Chemical Operations

1-3 hours credit. Prerequisite: CHE 3232 and consent of Division Director.

Practical introduction to industrial and/or similar applied chemistry operations, via supervised extracollegiate internship, resulting in a report. This course is taught on a credit/no credit basis only. Students completing this course will receive a grade of CR or NC.

4951-3 Special Studies in Chemistry

1-3 hours credit. Prerequisite: Upper division standing and consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies Courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4971 Proseminar

(0-3) 1 hour credit. Prerequisites: CHE 3003 and CHE 3204.

Oral reports and current publications in chemistry and chemical technology and the utilization of important chemical reference materials and periodicals. May be repeated for credit when topics vary, with consent of the Division Director.

4993 Honors Research

3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during the last two semesters; approval by the College Honors Committee.

Supervised research and preparation of an honors thesis. May be repeated only once with approval.

**BACHELOR OF SCIENCE DEGREE
IN GEOLOGY**

The Bachelor of Science Degree in Geology provides opportunities for preparation for careers in petroleum, mining, water resources, environmental management, governmental agencies, engineering geology, geochemistry, geophysics, and natural resources.

The minimum number of semester hours required for this degree, including the 42 semester hours of General Education Requirements, is 133.

All candidates for the degree must complete:

A. Division of Earth and Physical Science Requirements

58 semester hours in Geology minimum, 38 of which must be at the upper-division level.

1. *Specific Requirements: 45 Semester hours*

GEO 1003	Introduction to Geology
GEO 1011	Introduction to Geology Laboratory
GEO 1023	Earth History
GEO 1031	Earth History Laboratory
GEO 2003	Mineralogy
GEO 2011	Mineralogy Laboratory
GEO 2023	Optical Mineralogy
GEO 2031	Optical Mineralogy Laboratory
GEO 2063	Paleontology
GEO 2071	Paleontology Laboratory
GEO 3043	Petrology

GEO 3052	Petrology Laboratory
GEO 3083	Stratigraphy
GEO 3103	Structural Geology
GEO 3111	Structural Geology Laboratory
GEO 3123	Sedimentary Geology
GEO 3131	Sedimentary Geology Laboratory
GEO 3943	Field Methods in Geology
GEO 4946	Field Geology

2. *Additional Requirements: any 13 semester hours (maximum of 3 hours from GEO 4911-3, 4923, or 4951-3).*

GEO 3143	Economic Geology
GEO 3151	Economic Geology Laboratory
GEO 3163	Oceanography
GEO 3182	Geology of Energy Resources
GEO 3191	Geology of Energy Resources Laboratory
GEO 3373	Geochemistry
GEO 3383	General Geophysics
GEO 4023	Engineering Geology
GEO 4063	Principles of Environmental Geology
GEO 4113	Geomorphology
GEO 4121	Geomorphology Laboratory
GEO 4383	Exploration Geophysics
GEO 4391	Exploration Geophysics Laboratory
GEO 4401	Seismic Data Processing Laboratory
GEO 4413	Seismic Data Processing
GEO 4623	Groundwater Hydrology
GEO 4911-3	Independent Study
GEO 4951-3	Special Studies in Geology
GEO 4993	Honors Research

B. Requirements within the College of Sciences and Engineering: 27 semester hours are required in the College of Sciences and Engineering, with a minimum of 18 semester hours chosen from the following courses:

CHE 1103	Introductory Chemistry
CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis
CS 1073	Introductory Computer Programming for Scientific Applications, <i>or</i>
CS 1713	Introduction to Computer Science <i>and</i>
CS 1711	Introduction to Computer Science Laboratory
MAT 1223	Calculus II
PHY 1924	Technical Physics II, <i>or</i> PHY 1623 General Physics II
PHY 1931	Technical Physics II Laboratory, <i>or</i> PHY 1631 General Physics II Laboratory

2. *Additional Requirements: any 9 semester hours minimum with consent of advisor*

C. Six (6) semester hours of electives.

COURSE DESCRIPTIONS

GEOLOGY (GEO)

- 1003 Introduction to Geology**
(3-0) 3 hours credit. Concurrent enrollment in GEO 1011 recommended.
The Earth as a dynamic planet; relation of Earth's present day processes to its resources, structure and internal composition. Nature of minerals and rocks, the hydrosphere, tectonics, earthquakes, volcanism, and surface features of Earth.
- 1011 Introduction to Geology Laboratory**
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: GEO 1003.
Relation of Earth's present day processes to its resources, structure and internal composition. Field trips and laboratory study of minerals, rocks, maps and aerial and satellite photos.
- 1023 Earth History**
(3-0) 3 hours credit. Concurrent enrollment in GEO 1031 recommended.
Formation and evolution of the Earth, its life forms, and the major features of its surface.
- 1031 Earth History Laboratory**
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: GEO 1023.
Laboratory study of fossils and rock sequences; interpretation of Earth history.
- 2003 Mineralogy**
(3-0) 3 hours credit. Prerequisites: GEO 1003 and 1011, MAT 1093, CHE 1103, or consent of instructor. Concurrent enrollment: GEO 2011.
Crystallography, chemistry, physical properties and origins of minerals.
- 2011 Mineralogy Laboratory**
(0-2) 1 hour credit. Prerequisite: Concurrent enrollment: GEO 2003.
Laboratory study of crystal models, crystals and minerals.
- 2023 Optical Mineralogy**
(3-0) 3 hours credit. Prerequisites: GEO 2003 and 2011. Concurrent enrollment: GEO 2031.
Principles and methods of optical mineralogy. Optical properties of minerals and microscopic determination of opaque and non-opaque minerals.
- 2031 Optical Mineralogy Laboratory**
(0-3) 1 hour credit. Prerequisites: GEO 2003 and 2011. Concurrent enrollment: GEO 2023.
Use of the petrographic microscope for the identification of minerals.
- 2063 Paleontology**
(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, 1023, 1031, or consent of instructor. Concurrent enrollment: GEO 2071.
Study of fossil animals and plants. Emphasis on invertebrate animals. Systematics, biostratigraphy, paleoecology, and evolution of fossil organisms. Field trips required.
- 2071 Paleontology Laboratory**
(0-3) 1 hour credit. Prerequisites: GEO 1003, 1011, 1023 and 1031. Concurrent enrollment: GEO 2063.
Study of fossil specimens, collections and preparation techniques. Field trips required.
- 3023 Engineering Geology** ✓
(3-0) 3 hours credit. Prerequisites: PHY 1904; or PHY 1603 and MAT 1214; or consent of instructor.
Geologic factors in construction. Geotechnical properties of minerals, rocks and soils. Case studies. Field trips required.
- 3043 Petrology**
(3-0) 3 hours credit. Prerequisites: GEO 2023 and 2031. Concurrent enrollment: GEO 3052.
Description, classification, occurrence, and origin of igneous, metamorphic, and sedimentary rocks. Field trips required.

- 3052 Petrology Laboratory**
(0-4) 2 hours credit. Prerequisites: GEO 2023 and 2031. Concurrent enrollment: GEO 3043.
Laboratory study of rocks in hand specimen and thin section.
- 3083 Stratigraphy**
(3-0) 3 hours credit. Prerequisites: GEO 2063 and 2071, or consent of instructor.
Application of geologic principles to the interpretation of rocks formed at or near the surface of the earth. Field trips required.
- 3103 Structural Geology**
(3-0) 3 hours credit. Prerequisites: GEO 3043 and 3052. Concurrent enrollment: GEO 3111.
Response of earth materials to natural stresses. Description and origin of geologic structures. Field trips required.
- 3111 Structural Geology Laboratory**
(0-2) 1 hour credit. Concurrent enrollment: GEO 3103.
Laboratory study of geologic structures using maps, cross-sections, air photos, and descriptive geometric and stereographic methods.
- 3123 Sedimentary Geology**
(3-0) 3 hours credit. Prerequisite: GEO 3083. Prerequisite or concurrent enrollment: GEO 3043 and 3052.
Processes of erosion, transportation and deposition that form bodies of sedimentary rock. Depositional systems and modeling are a significant area of study. Field trips required.
- 3131 Sedimentary Geology Laboratory**
(0-3) 1 hour credit. Prerequisites: GEO 3042 and 3052. Concurrent enrollment: GEO 3123.
Laboratory studies of sedimentary processes and their products. Hand specimens, thin sections, sedimentary structures and interpretation of depositional environments. Field trips required.
- 3143 Economic Geology**
(3-0) 3 hours credit. Prerequisites: GEO 3043, 3052 or consent of instructor. Concurrent enrollment in GEO 3151.
Ore and industrial mineral genesis, origin, description and distribution of the major mineral deposits. Field trips required.
- 3151 Economic Geology Laboratory**
(0-2) 1 hour credit. Prerequisites: GEO 3043 and 3052. Concurrent enrollment in GEO 3143.
Study of rock and mineral suites from important ore localities. Identification of ore minerals. Textures, structures and alteration zones associated with ore deposits.
- 3163 Oceanography**
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
General oceanography, with emphasis on marine geology and especially the continental margins.
- 3182 Geology of Energy Resources**
(2-0) 2 hours credit. Prerequisites: GEO 3103 and 3111. Prerequisites or concurrent enrollment: GEO 3123 and 3131, or consent of instructor. Concurrent enrollment: GEO 3191.
Geology of petroleum, natural gas, coal, uranium; geothermal energy sources.
- 3191 Geology of Energy Resources Laboratory**
(0-3) 1 hour credit. Prerequisites: GEO 3103 and 3111. Prerequisites or concurrent enrollment: GEO 3123 and 3131 or consent of instructor. Concurrent enrollment: GEO 3182.
Laboratory studies of samples, maps, logs, and seismic data. Preparation and interpretation of subsurface maps.
- 3373 Geochemistry**
(2-2) 3 hours credit. Prerequisite: CHE 2003 or consent of instructor.

A survey of geochemical processes and the distribution of elements in the earth. Application of chemical methods and data to the solution of geologic problems.

3383 General Geophysics

(3-0) 3 hours credit. Prerequisites: GEO 3043 and 3052. Physics of the earth's interior, plate tectonics, geomagnetism, gravity and heat flow.

3943 Field Methods in Geology

(0-9) 3 hours credit. Prerequisite or concurrent enrollment in GEO 3123, 3131, 3103, 3111, and consent of instructor.

Use of surveying methods and topographic and aerial photo bases for geologic mapping. Description, recording, and interpretation of field relationships. Field trips required.

4063 Principles of Environmental Geology

(3-0) 3 hours credit. Prerequisites: GEO 1003 and 1011.

Geologic factors important to city and regional planning. Land capability studies; geologic hazards.

4113 Geomorphology

(3-0) 3 hours credit. Prerequisite: GEO 3083. Concurrent enrollment: GEO 4121.

Analysis of Cenozoic landform evolution.

4121 Geomorphology Laboratory

(0-3) 1 hour credit. Prerequisite: GEO 3083. Concurrent enrollment: GEO 4113.

Interpretation of maps and aerial photographs.

4383 Exploration Geophysics

(3-0) 3 hours credit. Prerequisites: GEO 3043, 3052, and PHY 1924; or PHY 1623 and MAT 1223. Concurrent enrollment: GEO 4391.

Principles of geophysical prospecting. Magnetic, gravity and seismic methods.

4391 Exploration Geophysics Laboratory

(0-3) 1 hour credit. Prerequisite: Concurrent enrollment: GEO 4383.

Laboratory and field studies of seismic methods. Seismic instrumentation.

4401 Seismic Data Processing Laboratory

(0-3) 1 hour credit. Prerequisite: Concurrent enrollment: GEO 4413.

Computer processing of seismic data.

4413 Seismic Data Processing

(3-0) 3 hours credit. Prerequisites: GEO 4383 and CS 1073 or CS 1713 and 1711. Concurrent enrollment: GEO 4401.

Introduction to computer methods, filtering, correlating, analysis, and display of seismic records. Wave propagation analysis for stratified media.

4623 Groundwater Hydrology

(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, and PHY 1904; or PHY 1603 and MAT 1214.

Hydrologic cycle and the theory of underground water. Recharge and discharge of aquifers; water quality; exploration and development of ground water supplies. Field trips required.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's Advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work. May be repeated for credit, but not more than 3 hours will apply to the bachelor's degree.

4923 Special Project

3 hours credit. Prerequisite: Consent of Division Director.

A special studies laboratory research or readings project resulting in a report. Limited to students in their final year of undergraduate study.

4946 Field Geology

(0-17) 6 hours credit. Prerequisites: GEO 3943 and consent of instructor.

Field mapping and measurements during a six-week period in summer. Field trips required.

4951-3 Special Studies in Geology

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to the bachelor's degree.

4993 Honors Research

3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during the last two semesters; approval by the College Honors Committee.

Supervised research and preparation of an honors thesis. May be repeated only once with approval.

**BACHELOR OF SCIENCE DEGREE
IN PHYSICS**

The Bachelor of Science Degree in Physics provides the opportunities for preparation for careers in industry, government agencies, and for graduate study in physics or other related fields.

The minimum number of semester hours required for this degree option, including the 42 semester hours of General Education Requirements, is 133.

All candidates for the degree must complete:

A. Division of Earth and Physical Sciences Requirements: 40 semester hours required.

1. *25 semester hours of required courses are:*

PHY 1904	Technical Physics I
PHY 1911	Technical Physics I Laboratory
PHY 1924	Technical Physics II
PHY 1931	Technical Physics II Laboratory
PHY 3103	Modern Physics
PHY 3203	Classical Mechanics I
PHY 3343	Advanced Physics Laboratory I
PHY 3353	Advanced Physics Laboratory II
PHY 3423	Electricity and Magnetism I

2. *Additional Requirements: any 15 semester hours (maximum of 3 hours from PHY 4911-3, 4923, 4951-3) with consent of advisor.*

PHY 2103	Techniques of Solving Problems in Science
PHY 2403	Electronics
PHY 3163	Theoretical Physics
PHY 3283	Thermal Physics
PHY 3293	Statistical Mechanics
PHY 3313	Solid State Physics I
PHY 3433	Introduction to the Theory of Solid State Electronics
PHY 3443	Optics
PHY 4203	Classical Mechanics II
PHY 4263	Quantum Mechanics I
PHY 4303	Solid State Physics II
PHY 4403	Electricity and Magnetism II
PHY 4423	Quantum Mechanics II
PHY 4911-3	Independent Study
PHY 4951-3	Special Studies in Physics
PHY 4993	Honors Research

- B. Requirements within the College of Sciences and Engineering (excluding Physics):
1. *51 semester hours required in the College of Sciences and Engineering, 24 of which are the following:*
 - MAT 1214 Calculus I
 - MAT 1223 Calculus II
 - MAT 2213 Calculus III
 - MAT 3613 Differential Equations I
 - CHE 1103 Introductory Chemistry
 - CHE 2003 Chemical Principles
 - CHE 2012 Inorganic Qualitative and Quantitative Analysis
 - CS 1073 Introductory Computer Programming for Scientific Applications
 2. *Additional Requirements: any 27 semester hours minimum with consent of advisor.*

COURSE DESCRIPTIONS

PHYSICS (PHY)

1013 Introduction to Physical Sciences

(3-0) 3 hours credit. Prerequisite: Freshman standing, first semester transfer student, or consent of instructor.

This course is designed to present primarily a nonmathematical overview of the physical sciences for students who have had little or no previous experience with the physical sciences; course should be of particular interest to elementary education majors. The general principles of physics and specifically atomic theory are utilized to explain commonly observed phenomena. Students majoring in the degrees granted by the College of Sciences and Engineering may not apply this course toward a degree.

1603 General Physics I

(3-0) 3 hours credit. Prerequisite: Knowledge of high school algebra, trigonometry, and geometry.

Motion, forces, conservation of energy and momentum, fluids, wave motion, and heat.

1611 General Physics I Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1603.

Laboratory to accompany PHY 1603.

1623 General Physics II

(3-0) 3 hours credit. Prerequisite: PHY 1603. Concurrent enrollment in PHY 1631 recommended.

Electrostatics, electromagnetism, light, sound, atomic and nuclear physics.

1631 General Physics II Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1623.

Laboratory to accompany PHY 1623.

1904 Technical Physics I

(4-0) 4 hours credit. Prerequisite: MAT 1214. Concurrent enrollment: PHY 1911 recommended.

The basic concepts and methods of physics. Mechanics, heat, and fluids.

1911 Technical Physics I Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1904.

Laboratory to accompany PHY 1904.

1924 Technical Physics II

(4-0) 4 hours credit. Prerequisite: PHY 1904. Prerequisite or concurrent enrollment: MAT 1223. Concurrent enrollment in PHY 1931 is recommended.

Electricity and magnetism, wave phenomena and elements of modern physics.

- 1931 Technical Physics II Laboratory**
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1924.
Laboratory to accompany PHY 1924.
- 2103 Techniques of Solving Problems in Science**
(1-4) 3 hours credit. Prerequisites: PHY 1924 and CS 1073.
Numerical methods and computer applications in solving fundamental problems in science.
- 2223 Musical Acoustics**
(3-0) 3 hours credit. Prerequisite: One year Music Theory desirable.
Vibrating systems, sound waves, sound phenomena, musical instruments, and basic concepts of audio electronics.
- 2403 Electronics**
(3-0) 3 hours credit. Prerequisite: PHY 1924.
AC circuits. The properties and application of diodes, transistors, digital and analog integrated circuits. Practical applications to electronic circuits are stressed.
- 3103 Modern Physics**
(3-0) 3 hours credit. Prerequisite: PHY 1924.
Special relativity, Planck's Radiation Law, elements of quantum mechanics, atomic and molecular structures and spectra. The atomic nucleus, nuclear reactions, and an introduction to elementary particles.
- 3163 Theoretical Physics**
(3-0) 3 hours credit. Prerequisites: PHY 1924 and MAT 2213.
Methods of theoretical physics applied to problems in electromagnetism, quantum and statistical physics, with an emphasis on physical formulation and interpretation.
- 3203 Classical Mechanics I**
(3-0) 3 hours credit. Prerequisite: PHY 1924. Prerequisite or concurrent enrollment: MAT 2213.
Kinematics and dynamics of systems of particles, rigid body motion. Applications are emphasized.
- 3283 Thermal Physics**
(3-0) 3 hours credit. Prerequisites: PHY 1924, CHE 2003 and MAT 1223.
Equilibrium states of single component substances. Thermodynamic laws and functions in quasi equilibrium processes, analysis of thermodynamic cycles.
- 3293 Statistical Mechanics**
(3-0) 3 hours credit. Prerequisites: PHY 1924, CHE 3203 or PHY 3283 and MAT 2213.
Kinetic Theory of macrosystems. Maxwell-Boltzman, Bose-Einstein, and Fermi-Dirac statistical distributions.
- 3313 Solid State Physics I**
(3-0) 3 hours credit. Prerequisite: PHY 3103.
Crystalline structures, phonons, energy bands, and semiconductor crystals.
- 3343 Advanced Physics Laboratory I**
(0-6) 3 hours credit. Prerequisites: PHY 1924 and 1931.
Laboratory experience in the areas of optics, modern physics, solid state and surface physics.
- 3353 Advanced Physics Laboratory II**
(0-6) 3 hours credit. Prerequisite: PHY 3343.
A continuation of PHY 3343.
- 3423 Electricity and Magnetism I**
(3-0) 3 hours credit. Prerequisite: PHY 1924. Prerequisite or concurrent enrollment: MAT 2213.
Vector calculus, electrostatics, magnetostatics, Faraday's Law, and Ohm's Law.
- 3433 Introduction to the Theory of Solid State Electronics**
(3-0) 3 hours credit. Prerequisites: PHY 2403 and PHY 3313 or consent of instructor.
Principles of intrinsic and extrinsic semiconductors. The theory of solid state devices.

**170 / Physics
Astronomy**

3443 Optics

(3-0) 3 hours credit. Prerequisite: PHY 3423.

The reflection, refraction, absorption, polarization, and diffraction of light. Filters and lasers.

4203 Classical Mechanics II

(3-0) 3 hours credit. Prerequisite: PHY 3203.

Advanced methods in mechanics, Lagrangian and Hamiltonian formulations.

4263 Quantum Mechanics I

(3-0) 3 hours credit. Prerequisites: PHY 3203 and 3423, or consent of instructor.

The Schrodinger equation, operators, and perturbation methods. Applications to the harmonic oscillator and the hydrogen atom.

4303 Solid State Physics II

(3-0) 3 hours credit. Prerequisite: PHY 3313.

Theory and applications of solid state physics to include: plasmas, optical properties, super-conductivity, ferroelectrics, and magnetism.

4403 Electricity and Magnetism II

(3-0) 3 hours credit. Prerequisite: PHY 3423.

Theory and applications of electromagnetic fields; Maxwell's equations.

4423 Quantum Mechanics II

(3-0) 3 hours credit. Prerequisite: PHY 4263.

The interaction of radiation with atomic systems, laser oscillations, band theory of electrons in crystals and charge transport.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work. May be repeated for credit, but not more than 3 hours will apply to the bachelor's degree.

4923 Special Project

3 hours credit. Prerequisite: Consent of Division Director.

A special studies laboratory research or readings project resulting in a report. Limited to students in their final year of undergraduate study.

4951-3 Special Studies in Physics

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to the bachelor's degree.

4993 Honors Research

3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during the last two semesters; approval by the College Honors Committee.

Supervised research and preparation of an honors thesis. May be repeated only once with approval.

COURSE DESCRIPTIONS

ASTRONOMY (AST)

1013 Introduction to Astronomy

(3-0) 3 hours credit.

A descriptive course including the development of astronomy, and its methods, the motions, laws and evolution of the solar system. The general properties and types of stars, unusual stellar objects such as quasars and black holes, galaxies, evolution and cosmology. Occasional evening viewing sessions are held.

1031 Introduction to Astronomy Laboratory

(0-2) 1 hour credit. Prerequisite: AST 1013 or consent of instructor.

Exercises in the use of the telescope and certain other astronomical instruments to include simple observations, measurement and photography.

COURSE DESCRIPTIONS
ENVIRONMENTAL - NATURAL RESOURCES
(ENV)

2013 Introduction to Environmental Systems

(3-0) 3 hours credit.

An introduction to the principles of man-machine-community interrelationships within the natural and built environments. General attention is given to the concepts of "growth", "processes", and "changes" occurring in ecosystems and social structures. Emphasis is placed on understanding system dynamics and how these relate to public policy formulation and natural resource utilization.

3023 Man and His Natural Resources

(3-0) 3 hours credit.

An in-depth analysis of man's dependency upon the major natural resources of the earth such as water, air, soils, forests, grasslands, minerals, fuels and wildlife, and the environmental problems that arise through societal mismanagement.

DIVISION OF ENGINEERING

The Division of Engineering offers a Bachelor of Science Degree in Civil Engineering, a Bachelor of Science Degree in Electrical Engineering, and a Bachelor of Science Degree in Mechanical Engineering. Each of these degree programs is designed to provide students the opportunity to develop a strong foundation in science and mathematics coupled with a strong program in engineering analysis, design, synthesis, and evaluation.

Entering lower division students who intend to pursue an engineering degree enroll as Pre-Engineering majors and complete the Pre-Engineering requirements. The Pre-Engineering requirements include those courses listed in IIA below plus ENG 1013 and ENG 1023. Students who complete the Pre-Engineering requirements with a GPA of 2.5 and who have an overall GPA of 2.5 may apply for admission to the Professional Program as Civil, Electrical or Mechanical Engineering majors.

All courses that are prerequisites to **required CE, EE, ME, or EGR** courses in the degree requirements of Civil, Electrical, or Mechanical Engineering must be completed with a grade of C or better. All students in the Division of Engineering must complete a minimum of 16 semester hours of approved science courses.

DEGREE REQUIREMENTS

I. General Education Requirements

All students in the Division of Engineering must satisfy the 42 semester hour General Education Requirements established by The University of Texas at San Antonio. In order to satisfy these requirements and the humanities and social sciences requirements of the Accreditation Board for Engineering and Technology, students in the Division of Engineering must take at least one upper division course in any of the following areas: philosophy, religion, history, literature, art, music, sociology, psychology, anthropology, economics, or foreign languages other than a student's native language(s). In addition, Engineering students are encouraged to take ECO 2013 to satisfy the General Education Requirement in Economics.

II. General Engineering Requirements

All degree candidates in the Division of Engineering must complete the following 50 semester hours.¹⁰

A. Pre-Engineering Requirements

- CHE 1103 Introductory Chemistry
- CHE 2003 Chemical Principles
- CS 2073 Programming with Engineering Applications
- EGR 1103 Introduction to Engineering
- EGR 2203 Statics
- MAT 1214 Calculus I
- MAT 1223 Calculus II
- MAT 2213 Calculus III
- PHY 1904 Technical Physics I
- PHY 1911 Technical Physics I Lab
- PHY 1924 Technical Physics II
- PHY 1931 Technical Physics II Lab

B. Advanced Requirements

- EGR 2503 Dynamics
- EGR 4713 Engineering Economic Analysis

¹⁰CHE 1103, MAT 1214, and CS 2073 may be used to satisfy the General Education Requirement for three hours of Science, three hours of Mathematics/Statistics, and three hours of Computer Science/Logic.

Bachelor of Science Degree in Civil Engineering
Bachelor of Science Degree in Electrical Engineering

ENG 2413	Technical Writing
MAT 3253	Engineering Analysis I
MAT 3263	Engineering Analysis II

**BACHELOR OF SCIENCE DEGREE IN
CIVIL ENGINEERING**

The minimum number of semester hours required for this degree is 140.

A. Required Courses (42 hours)

CE 2103	Civil Engineering Measurements
CE 3113	Structural Analysis
CE 3213	Reinforced Concrete Design
CE 3233	Steel Design
CE 3243	Properties and Behavior of Engineering Materials
CE 3603	Hydraulic Engineering
CE 4213	Geotechnical Engineering
CE 4633	Water and Wastewater Treatment
CE 4813	Civil Engineering Design
ME 3293	Thermodynamics I
ME 3663	Fluid Mechanics
EGR 3213	Mechanics of Solids
GEO 3023	Engineering Geology
STA 3513	Probability and Statistics

B. Civil Engineering Electives (15 hours). A minimum of 12 hours must be in Civil Engineering, 9 hours of which must be from the following list.

These electives must be chosen such that the student's program of study contains a minimum of one-half year of Engineering Design, as defined by the Accreditation Board for Engineering and Technology. A listing of the design content in Civil Engineering courses can be obtained from the Division of Engineering.

CE 4313	Computer-Aided Design in Civil Engineering
CE 4413	Foundation Engineering
CE 4513	Advanced Structural Analysis
CE 4523	Advanced Reinforced Concrete Design
CE 4653	Design of Water Pollution Control Systems
CS 3073	Graphics And Numerical Techniques

BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

The minimum number of semester hours required for this degree is 139.

A. Required Courses (41 hours)

EE 2424	Network Theory I
EE 2514	Introduction to Computer Engineering
EE 3113	Electrical Engineering Lab I
EE 3213	Electromagnetic Engineering
EE 3313	Electronic Circuits I
EE 3423	Network Theory II
EE 3513	Electromechanical Systems
EE 4113	Electrical Engineering Lab II
EE 4313	Electronic Circuits II
EE 4413	Analysis and Design of Control Systems

**174 / Bachelor of Science Degree in Electrical Engineering
Bachelor of Science Degree in Mechanical Engineering**

EE 4813 Electrical Engineering Design
STA 3533 Probability and Random Processes
Engineering Science Elective (3 hours). Choose from EGR
3213, ME 3243 or ME 3293.

- B. Electrical Engineering Electives (15 hours). A minimum of 12 hours must be in Electrical Engineering, 9 hours of which must be from the following list.

These electives must be chosen such that the student's program of study contains a minimum of one-half year of Engineering Design, as defined by the Accreditation Board for Engineering and Technology. A listing of the design content in Electrical Engineering courses can be obtained from the Division of Engineering.

CS 3073 Graphics and Numerical Techniques
EE 3563 Digital Systems Design I
EE 3573 Digital Systems Laboratory
EE 4333 Instrumentation Systems
EE 4443 Discrete-Time and Computer-Controlled Systems
EE 4563 Microcomputer Systems
EE 4613 Analog Communication Systems
EE 4623 Digital Filtering

BACHELOR OF SCIENCE DEGREE IN MECHANICAL ENGINEERING

The minimum number of semester credit hours required for this degree is 140.

- A. Required Courses (42 hours)

EE 2213 Electric Circuits and Electronics
EE 3502 Electronics and Electromechanical Systems Lab
EE 3513 Electromechanical Systems
EGR 3213 Mechanics of Solids
ME 3241 Materials Engineering Laboratory
ME 3243 Materials Engineering
ME 3293 Thermodynamics I
ME 3313 Measurements and Instrumentation
ME 3513 Mechanism Design
ME 3523 Machine Element Design
ME 3663 Fluid Mechanics
ME 4293 Thermodynamics II
ME 4313 Heat Transfer
ME 4813 Mechanical Engineering Design
STA 3513 Probability and Statistics

- B. Mechanical Engineering Electives (15 hours). A minimum of 12 hours must be in Mechanical Engineering, 9 hours of which must be from the following list.

These electives must be chosen such that the student's program of study contains a minimum of one-half year of Engineering Design, as defined by the Accreditation Board for Engineering and Technology. A listing of the design content in Mechanical Engineering courses can be obtained from the Division of Engineering.

CS 3073 Graphics And Numerical Techniques
ME 3353 Dynamic Systems and Controls
ME 3533 Mechanical Engineering Design Methodology
ME 4323 Thermal System Design I
ME 4333 Thermal System Design II

Bachelor of Science Degree in Mechanical Engineering / 175
Engineering
Civil Engineering

- ME 4603 CAD/CIM Methodology
- ME 4703 Computer Applications in Mechanical Engineering
- ME 4803 Mechanical Engineering Senior Laboratory

COURSE DESCRIPTIONS
ENGINEERING
(EGR)

- 1103 Introduction to Engineering**
(2-3) 3 hours credit. Prerequisites: Pre-Engineering major and credit for or enrollment in MAT 1214.
Engineering as a career. Approaches to engineering problem solving and design through the use of engineering principles. Technical communication, engineering graphics, and an introduction to computer graphics.
- 1203 Introduction to Science and Technology**
(3-0) 3 hours credit.
This course examines the current state and future directions of science and technology. Topics for discussion will be drawn from the biological sciences, earth and physical sciences, computer science, and engineering.
- 2203 Statics**
(3-0) 3 hours credit. Prerequisites: PHY 1904 and MAT 1223.
Vector algebra, force systems, free body diagrams. Engineering applications of equilibrium, centroids, moments of inertia. Credit may not be obtained for both AS 2203 and EGR 2203.
- 2503 Dynamics**
(3-0) 3 hours credit. Prerequisites: EGR 2203, PHY 1924, and credit for or enrollment in MAT 2213.
Study of motion of particles and rigid bodies. Kinetics and kinematics: force and acceleration, work and energy, impulse and momentum; vibrations. Engineering applications are emphasized.
- 3213 Mechanics of Solids**
(3-0) 3 hours credit. Prerequisite: EGR 2203.
Internal forces and deformations in solids; stress, strain in elastic and plastic solids; application to engineering problems.
- 4713 Engineering Economic Analysis**
(3-0) 3 hours credit. Prerequisite: Senior standing in the Division of Engineering.
Techniques of economic analysis for engineering decisions, economic evaluation, and risk assessment.
- 4993 Honors Research**
3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during the last two semesters; approval by the College Honors Committee.
Supervised research. May be repeated once with approval only.

COURSE DESCRIPTIONS
CIVIL ENGINEERING
(CE)

- 2103 Civil Engineering Measurements**
(2-3) 3 hours credit. Prerequisites: CS 2073 and MAT 2213.
Computations, error analysis, basic principles of surveying, and introduction to the use of surveying equipment.
- 3113 Structural Analysis**
(3-0) 3 hours credit. Prerequisite: EGR 3213.
Forces and deflections in structural systems considering stationary and moving loads, exact and approximate methods.

3213 Reinforced Concrete Design

(2-3) 3 hours credit. Prerequisite: Credit for or enrollment in CE 3113.
Ultimate strength theory and design for reinforced concrete members.

3233 Steel Design

(2-3) 3 hours credit. Prerequisite: CE 3113.
Analysis and design of tension members, beams, columns and bolted or welded connections.

3243 Properties and Behavior of Engineering Materials

(2-3) 3 hours credit. Prerequisite: EGR 3213.
Structure, properties, and behavior of engineering materials including concrete and metals. Laboratory exercises illustrate mechanical behavior of typical materials and demonstrate selected principles of mechanics.

3603 Hydraulic Engineering

(2-3) 3 hours credit. Prerequisite: ME 3663.
Flow in open channels and natural streams, sediment movement, hydrology, urban drainage, and water resources.

3673 Municipal and Rural Sanitation

(3-0) 3 hours credit. Prerequisites: CHE 2003 and upper-division standing.
An examination of sanitation practices in rural and urban environments including insect and rodent control, swimming pool sanitation, rural water supply, food sanitation, and disease transmission. Credit cannot be earned for any two of AS 3673, BIO 3233, and CE 3673.

4113 Transportation Systems

(3-0) 3 hours credit. Prerequisite: Credit for or enrollment in EGR 4713.
Planning, design, construction, operation and maintenance of transportation systems; concepts of various modes of transportation.

4123 Highway Engineering

(3-0) 3 hours credit. Prerequisite: Senior standing in Civil Engineering.
General characteristics of highway design. Horizontal and vertical alignment, cross-sections, earthwork, drainage, pavement. Economic analysis.

4213 Geotechnical Engineering

(2-3) 3 hours credit. Prerequisites: EGR 3213 and ME 3663.
Engineering properties of soils, settlement of embankments and foundations of structures, bearing capacity of foundations, and laboratory measurements.

4223 Earth Structure and Stability

(3-0) 3 hours credit. Prerequisite: CE 4213.
Stability, strength, and deformation characteristics of engineering in and on geotechnical materials.

4313 Computer-Aided Design in Civil Engineering

(2-3) 3 hours credit. Prerequisite: Senior standing in Civil Engineering.
Organization and programming of civil engineering problems for computer solutions. Application of commercially available design software.

4413 Foundation Engineering

(3-0) 3 hours credit. Prerequisite: CE 4213.
Design of foundations and earth retaining structures; study of earth-pressure theories.

4513 Advanced Structural Analysis

(2-3) 3 hours credit. Prerequisite: CE 3113.
Digital computer analysis of linear structural systems. Theoretical basis for modern computer programs. Application of several standard programs for a variety of structures.

4523 Advanced Reinforced Concrete Design

(2-3) 3 hours credit. Prerequisite: CE 3213.
Design of reinforced concrete buildings by ultimate strength methods. Pre-stressed concrete design.

4633 Water and Wastewater Treatment

(3-0) 3 hours credit. Prerequisites: CHE 2003 and ME 3663.

The application of chemical, biochemical, physical and mathematical processes to water treatment, wastewater treatment and pollution control. Credit may not be obtained for both AS 4633 and CE 4633.

4643 Air Pollution and Industrial Hygiene

(3-0) 3 hours credit. Prerequisites: CHE 2003 and upper-division standing. Discussion of the sources, quantities, effects of sampling and control of airborne pollutants in ambient air, and in urban and industrial environments. Credit cannot be earned for any two of AS 4643, BIO 4493, or CE 4643.

4653 Design of Water Pollution Control Systems

(3-0) 3 hours credit. Prerequisite: CE 4633. Analysis, synthesis, design, and system optimization of integrated processes and operations to handle and treat water and wastewater.

4713 Systems Engineering Applications in Civil Engineering

(3-0) 3 hours credit. Prerequisite: Senior standing in Civil Engineering. Introduction to systems approach to problem solving. Application of operations research in civil engineering; mathematical modeling and analysis techniques including marginal analysis, linear programming, and dynamic programming.

4813 Civil Engineering Design

(1-6) 3 hours credit. Prerequisites: CE 3213, CE 3233, CE 3603 and CE 4633. Significant development of instructor-approved individual and/or group project. Synthesis, modeling, computer-aided analysis and optimization. Industrial cooperation encouraged. Formal presentation of progress and final reports.

4911-3 Independent Study

1-3 hours credit. Prerequisite: Permission in writing (form available) of the instructor, the student's advisor, the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to the bachelor's degree.

4951-3 Special Studies in Civil Engineering

1-3 hours credit. Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

**COURSE DESCRIPTIONS
ELECTRICAL ENGINEERING
(EE)**

2213 Electric Circuits and Electronics

(3-0) 3 hours credit. Prerequisites: PHY 1924, PHY 1931, and credit for or enrollment in MAT 3253.

Electric, magnetic, and electronic circuits; transients, transforms, phasors; solid state devices; analog and digital circuits. Not open to electrical engineering majors.

2424 Network Theory I

(3-3) 4 hours credit. Prerequisites: PHY 1924, PHY 1931, and credit for or enrollment in MAT 3253.

Basic network principles; steady state response to DC and AC signals; simple transient response; nodal and loop analysis. Introduction to basic laboratory instrumentation with applications to fundamental circuit theory concepts.

2514 Introduction to Computer Engineering

(3-3) 4 hours credit. Prerequisites: CS 2073 and credit for or enrollment in EE 2424 and MAT 3253. Number systems, Boolean algebra, combinatorial and sequential circuit design, computer organization.

3113 Electrical Engineering Laboratory I

(1-4) 3 hours credit. Prerequisites: Credit for or enrollment in EE 3313 and EE 3423. Basic experimental methods, theory and practice of measurements, limitation of theoretical models, digital computer applications.

3213 Electromagnetic Engineering

(3-0) 3 hours credit. Prerequisites: Credit for or enrollment in EE 3423 and MAT 3263. Analysis and design of electromagnetic systems; utilization of conductive, dielectric and magnetic materials in components; engineering applications of Maxwell's equations to electrical and electromagnetic wave systems.

3313 Electronic Circuits I

(3-0) 3 hours credit. Prerequisites: CHE 2003, EE 2514 and credit for or enrollment in EE 3423.

Electrical properties of semiconductors; P-N junctions; diode circuits; BJT's, FET's; application to basic digital and analog circuits.

3423 Network Theory II

(3-0) 3 hours credit. Prerequisites: EE 2424, MAT 3253, and credit for or enrollment in MAT 3263.

Circuit analysis by transform, frequency, and time domain techniques. Computer methods for network analysis and design.

3502 Electronics and Electromechanical Systems Laboratory

(0-6) 2 hours credit. Prerequisites: EE 2213 and credit for or enrollment in EE 3513. Basic experiments in analog and digital circuits, electronic instrumentation, and electromechanical devices. Not open to electrical engineering majors.

3513 Electromechanical Systems

(3-0) 3 hours credit. Prerequisites: EE 2213 or (EE 3213 and EE 3423), and credit for or enrollment in MAT 3263.

Principles of electromechanical energy conversion; magnetic circuits, polyphase circuits; dynamic analysis of energy-transfer devices. Consideration of modern actuator systems such as used in robotics.

3563 Digital Systems Design I

(3-0) 3 hours credit. Prerequisites: EE 2514 and EE 3313.

Design of combinatorial and sequential circuits including formulation, minimization, and implementation. Circuit properties of digital integrated circuits and systems.

3573 Digital Systems Laboratory

(0-6) 3 hours credit. Prerequisite: Credit for or enrollment in EE 3563.

Laboratory to accompany EE 3563, Digital Systems Design I. Design, implementation, and test of digital subsystems with emphasis on topics related to EE 3563.

3583 Digital Systems Design II

(2-3) 3 hours credit. Prerequisite: EE 3563.

Design of computer subsystems and advanced state machines. Peripheral controller design and implementation; hybrid analog/digital systems. Advanced logic simulation and trouble-shooting techniques.

4113 Electrical Engineering Lab II

(1-4) 3 hours credit. Prerequisites: EE 3113 and credit for or enrollment in EE 4313.

Experiments with integrated circuits and electronic subsystems; analysis, design, test, and evaluation. Advanced topics include bus-controlled instrument systems.

4313 Electronic Circuits II

(3-0) 3 hours credit. Prerequisites: EE 3313 and EE 3423.

Multiple transistor circuits; feedback and frequency response analysis; advanced op amp design and applications. Power semiconductor circuits; other topics.

4333 Instrumentation Systems

(2-3) 3 hours credit. Prerequisite: EE 4313.

Principles of instrumentation design; power supplies, signal conditioning, signal processing, buffering, noise analysis and noise reduction techniques. Instrumentation system interconnection via standard protocol buses. Transducer techniques for a variety of physical parameters.

4343 Active Filter Synthesis

(3-0) 3 hours credit. Prerequisite: EE 4313.

Analysis and design of active filter networks. Classification of filter responses; sensitivity analysis; filter design methodologies. Design and analysis using poles and zeros. Switched capacitor filters, passive synthesis, and other selected topics.

4413 Analysis and Design of Control Systems

(3-0) 3 hours credit. Prerequisite: MAT 3263 and credit for or enrollment in EE 4313.

Modeling, analysis, and design of linear automatic control systems. Time and frequency domain techniques; stability analysis; state variable formulation; frequency plots; other topics including nonlinear systems; computer simulation techniques.

4443 Discrete-Time and Computer-Controlled Systems

(2-3) 3 hours credit. Prerequisite: EE 4413.

Sampled-data techniques applied to the analysis and design of modern digital control systems. Stability criteria, compensation, and other topics. Application topics include robotic systems.

4453 Principles of Bioengineering and Bioinstrumentation

(2-3) 3 hours credit. Prerequisites: EE 3113 and EE 4413.

Theoretical basis for signal generation, transmission, and detection from biological systems. Modeling of biological systems. Electrodes and transducer systems; signal excitation and processing instrumentation.

4513 LSI and VLSI Design

(2-3) 3 hours credit. Prerequisite: EE 3583.

Design of advanced digital systems with emphasis on large-scale integrated circuit design. Logic simulation, standard cell libraries, routing, and other computer-aided design tools are considered.

4523 Integrated Circuit Design

(2-3) 3 hours credit. Prerequisite: EE 4313.

Advanced circuit design for linear integrated circuits. Analysis and design techniques; computer-aided design and simulation.

4563 Microcomputer Systems

(2-3) 3 hours credit. Prerequisite: EE 3563.

Design of microprocessor-based systems; architecture, assembly language; development tools; system integration; design for reliability and testability.

4573 Engineering Workstations

(2-3) 3 hours credit. Prerequisite: EE 3563.

Design and application of engineering workstations. Integration of components and peripherals to address specific engineering design support requirements. Networking considerations for establishing a system design hierarchy.

4613 Analog Communication Systems

(3-0) 3 hours credit. Prerequisites: EE 4313 and credit for or enrollment in STA 3533.

Fundamental analog communication systems including AM and FM. Analysis of performance to include spectrum requirements, signal-to-noise ratio, and associated circuit implementations.

4623 Digital Filtering

(2-3) 3 hours credit. Prerequisite: EE 3423, MAT 3263, and credit for or enrollment in STA 3533.

Discrete representation and analysis of digital signals and filter topologies. Design and implementation of FIR and IIR filters; hardware and software. Adaptive filters.

4643 Digital Signal Processing

(2-3) 3 hours credit. Prerequisite: EE 3423, MAT 3263, and credit for or enrollment in STA 3533.

Transform techniques for discrete signal analysis. Fast Fourier Transform, Discrete Cosine Transform; other orthogonal transforms. Convolution, correlation, pattern recognition, and other topics.

4653 Digital Communication Systems

(3-0) 3 hours credit. Prerequisites: EE 4313 and credit for or enrollment in STA 3533.

**180 / Electrical Engineering
Mechanical Engineering**

Theory and design of digital communication systems. Analysis of signal representations, channel statistics information coding, modulation, etc. Optimum receiver design and essential communication electronic circuits are considered.

4683 Advanced Communications Laboratory

(0-6) 3 hours credit. Prerequisites: EE 4113 and credit for or enrollment in EE 4613 or EE 4653.

Design and implementation of communication electronic circuits operating at LF, VHF, and UHF frequencies.

4813 Electrical Engineering Design

(1-6) 3 hours credit. Prerequisites: EE 4113 and EE 4313.

Project-oriented course which emphasizes the formulation, analysis, design, implementation, and evaluation of engineering design problems. Practical design problems drawn from industry where possible.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to the bachelor's degree.

4951-3 Special Studies in Electrical Engineering

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

**COURSE DESCRIPTIONS
MECHANICAL ENGINEERING
(ME)**

3241 Materials Engineering Laboratory

(0-3) 1 hour credit. Prerequisite: Credit for or enrollment in ME 3243.

Investigation of the properties of engineering materials with emphasis on metals; sample preparation, metallography, foundry processes.

3243 Materials Engineering

(3-0) 3 hours credit. Prerequisites: CHE 1103, MAT 2213, and credit for or enrollment in EGR 3213.

Fundamental aspects of the structure, properties and behavior of engineering materials.

3263 Materials Processing

(2-3) 3 hours credit. Prerequisites: ME 3243 and EGR 2503.

Casting, joining, forming and machining; effects of processing on materials.

3293 Thermodynamics I

(3-0) 3 hours credit. Prerequisites: CHE 2003, and EGR 2503.

Heat, kinetic theory of gases, laws of thermodynamics and their practical applications to thermodynamic devices including engines.

3313 Measurements and Instrumentation

(2-3) 3 hours credit. Prerequisites: EE 2213, EGR 2503 and MAT 3253.

Fundamentals of measurement systems; standards, treatment of data; transducers, signal conditioning; strain, force, acceleration, pressure, temperature, fluid flow.

3353 Dynamic Systems and Controls

(2-3) 3 hours credit. Prerequisites: EGR 2503, EE 3513, and credit for or enrollment in ME 3313 and MAT 3263.

Lumped physical system models; electrical, fluid, mechanical, and thermal system analysis; linear system transients; steady-state behavior; introduction to feedback control.

3503 Alternative Energy Sources

(3-0) 3 hours credit. Prerequisite: ME 3293.

Solar, nuclear, wind, geothermal and tidal energy. Energy storage problems. Principles, current technology, and economic considerations.

3513 Mechanism Design

(2-3) 3 hours credit. Prerequisite: EGR 2503.

Design of mechanisms; kinematic and kinetic analysis; emphasis on computer-assisted methodologies; several short design projects.

3523 Machine Element Design

(3-0) 3 hours credit. Prerequisites: EGR 3213 and credit for or enrollment in MAT 3263.

The theoretical and practical aspects of the design of machine elements and simple systems; stress analysis and failure theory.

3533 Mechanical Engineering Design Methodology

(2-3) 3 hours credit. Prerequisite: ME 3523.

Design methodology for mechanical systems and components; creative design, analysis, selection, development and fabrication of engineering components and systems; several short design projects.

3663 Fluid Mechanics

(3-0) 3 hours credit. Prerequisites: EGR 2503 and credit for or enrollment in ME 3293.

Fluid properties; fluid statics, concepts and equations of fluid flow; similitude; viscous effects; compressible fluid flow.

4243 Intermediate Materials Engineering

(3-0) 3 hours credit. Prerequisites: ME 3243, ME 3241 and ME 3523.

Selected topics in ceramics, polymers; introduction to composites, fracture mechanics and corrosion; engineering design applications in material selection for control of fracture, deflection, wear and corrosion.

4293 Thermodynamics II

(3-0) 3 hours credit. Prerequisites: ME 3293, and credit for or enrollment in ME 3663.

Nonreactive and reactive mixtures, vapor and gas power cycles, refrigeration, and compressible flow.

4313 Heat Transfer and Rate Processes

(3-0) 3 hours credit. Prerequisites: MAT 3253, ME 3293 and credit for or enrollment in ME 3663.

Generalized potential distribution and gradients; transient and steady heat conduction; forced and free convection; radiation, energy, and momentum transfers.

4323 Thermal Systems Design I

(2-3) 3 hours credit. Prerequisite: Credit for or enrollment in ME 4313.

Application of basic thermodynamics, fluid mechanics, heat transfer and computer methods to the design of heat exchanger systems.

4333 Thermal Systems Design II

(2-3) 3 hours credit. Prerequisite: Credit for or enrollment in ME 4313.

Design of thermal energy systems; coils, fans, pumps, and filter systems; automatic control systems.

4343 Heating, Air Conditioning, and Refrigeration

(2-3) 3 hours credit. Prerequisite: ME 4293.

Heating, ventilation, and air conditioning of buildings for human comfort or industrial processes; design selection, construction and operation of air conditioning equipment and refrigeration systems.

4353 Gas Dynamics

(3-0) 3 hours credit. Prerequisites: ME 3293 and ME 3663.

Application of mass, energy and force balance to compressible fluids, treatment of one-dimensional steady and transient flows, isentropic flow, adiabatic flow, flow with friction. Application to duct flows and to jet and rocket propulsion engines.

4363 Intermediate Heat Transfer

(3-0) 3 hours credit. Prerequisite: ME 4313.

Multidimensional heat conduction, numerical solutions, selected topics in natural convection, boiling and condensation heat transfer, thermal storage systems.

4503 Intermediate Dynamics

(3-0) 3 hours credit. Prerequisite: EGR 2503.

Three-dimensional rigid-body kinetics, vector algebraic and Lagrange methods; integration of equations of motion; computer-assisted methods.

4513 Mechanical Vibrations and Dynamics of Machinery

(2-3) 3 hours credit. Prerequisites: EGR 2503, MAT 3253, and credit for or enrollment in MAT 3263.

Free and forced single and multiple degree of freedom systems modeled as both discrete and continuous. Applications in mechanical engineering design problems in the transmission and control of vibration.

4603 CAD/CIM Methodology

(1-6) 3 hours credit. Prerequisites: ME 3523 and ME 3533.

Computer-assisted/aided design (CAD) topics; computer-integrated manufacturing (CIM) methodologies.

4613 Power Systems Design

(2-3) 3 hours credit. Prerequisites: ME 4293.

Application of basic fluid mechanics to the design of turbomachinery, turbines, pumps, compressors, fans, blowers, windmills, and combustion engines.

4663 Intermediate Fluid Mechanics

(3-0) 3 hours credit. Prerequisite: ME 3663.

Continuation of ME 3663. Potential flow theory, analysis of laminar and turbulent flows; introduction to boundary layer theory, and application of basic equations to engineering problems.

4703 Computer Applications in Mechanical Engineering

(2-3) 3 hours credit. Prerequisites: CS 2073, ME 3523, ME 4293, and credit for or enrollment in ME 4313.

Application of computers in mechanical and thermal design; software package development; program development includes: fluid flow and mechanical property characterization, and heat transfer determination.

4713 Robotics, Expert Systems and Artificial Intelligence

(2-3) 3 hours credit. Prerequisite: ME 3353.

Design and industrial application of robots; expert systems; stereometry; machine vision, artificial intelligence.

4723 Reliability in Engineering Design

(3-0) 3 hours credit. Prerequisites: STA 3513 and senior standing in the Division of Engineering.

Introduction to applied statistical methods in reliability and probabilistic design methodology; applications in engineering design problems; interference theory, selection of statistical distributions, life prediction and testing, and design optimization.

4803 Mechanical Engineering Senior Laboratory

(1-4) 3 hours credit. Prerequisites: ME 3313, ME 3523, and credit for or enrollment in ME 4313.

An experimental laboratory concerned with fluid statics, fluid flow, heat transfer, internal combustion engines, and rotating machinery.

4813 Mechanical Engineering Design

(1-6) 3 hours credit. Prerequisites: ME 3523, ME 4293, and ME 4313.

Significant development of instructor-approved individual and/or group design project. Synthesis, modeling, computer-aided analysis and optimization. Industrial cooperation encouraged. Formal presentation of progress and final reports.

4911-3 Independent Study

1-3 hours credit. Prerequisite: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to the bachelor's degree.

4951-3 Special Studies in Mechanical Engineering

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

DIVISION OF LIFE SCIENCES

The Division offers a Bachelor of Science Degree in Biology, with emphasis in molecular cell biology and neurobiology, as well as joint degree programs with The University of Texas Health Science Center at San Antonio, leading to the Bachelor of Science Degree in Medical Technology, Occupational Therapy, or Physical Therapy. Degrees in these three Allied Health programs are awarded jointly by both institutions. Also available are pre-professional courses which offer the students the opportunity to prepare for admission to medical, dental, nursing, and other professional schools.¹¹

The B.S. Degree in Biology is structured around a comprehensive core curriculum and related offerings in chemistry, physics, and mathematics which lead to more highly specialized areas in the life sciences, such as biochemistry, cellular biology, developmental biology, ecology, neurobiology, genetics, microbiology, molecular biology, and physiology.

The B.S. Degree in Medical Technology is a joint degree between The University of Texas at San Antonio and The University of Texas Health Science Center at San Antonio. The preclinical curriculum includes general education requirements, basic science lecture and laboratory courses and medical technology courses. The Joint Degree Program is a four year program of study offered by UTSA and The University of Texas Health Science Center and the degree is awarded jointly by both institutions. Medical technology concepts are introduced throughout the curriculum, ending in a senior year clinical rotation at the Health Science Center. Upon completion of all requirements the student is eligible to take one of the medical technology national board examinations.

The Bachelor of Science Degree in Occupational Therapy offers the opportunity for the student to gain a strong background in the life sciences, behavioral sciences, humanities, and special skill areas. Specific application of occupational therapy skills in laboratory and clinical settings occurs in the last two years of a student's program and includes a minimum of six months approved field work experience. Students who have completed all degree requirements and their field work are eligible to take the national examination for registration with the American Occupational Therapy Association. An additional fieldwork placement course (OCCT 40876) is optional.

The B.S. Degree in Physical Therapy offers the opportunity for students to emphasize the basic sciences necessary to understand human response during illness and disability, as well as during the rehabilitation process. Clinical observation and field work experiences are integrated into the academic preparation during the professional phase of the program. This program is fully accredited by the American Physical Therapy Association and students are eligible to take the Physical Therapy licensure examination following successful completion of this joint degree program.

BACHELOR OF SCIENCE DEGREE IN BIOLOGY

The minimum number of semester hours required for the Bachelor of Science Degree in Biology, including the 42 hours of General Education Requirements, is 126.¹² All candidates for the degree must complete:

- A. 48 semester hours in the *major*, 32 of which must be at the upper-division level.
 - 1. 30 semester hours in the Biology Core Curriculum are required:

¹¹Specific premedical, predental, and prenursing programs are not offered at UT San Antonio. Admission requirements for these professional schools are outlined in the Appendix of this catalog. Additional information can be obtained from the Office of the Division of Life Sciences and through the Chairman of the Health Related Professions Advisory Committee of The University of Texas at San Antonio.

¹²Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

Bachelor of Science Degree in Biology / 185
UTSA/UTHSC Joint Bachelor of Science Degree in Medical Technology

BIO 1103, 1112 Principles of Biology and Laboratory
BIO 2313, 2322 Genetics and Laboratory
BIO 3413, 3422 General Physiology and Laboratory
BIO 3513, 3522 Biochemistry and Laboratory

and two of the following with laboratories:

BIO 3143, 3152 Developmental Biology
BIO 3283, 3292 Principles of Ecology
BIO 3713, 3722 Microbiology
BIO 3813, 3822 Cellular Biology
BIO 4433, 4442 Neurobiology

2. 18 additional semester hours of Biology electives are required, 12 of which must be at the upper-division level.

B. 24 semester hours minimum of support work.

1. 13 semester hours are required in Chemistry:

CHE 1103 Introductory Chemistry
CHE 2003 Chemical Principles
CHE 2012 Inorganic Qualitative and Quantitative Analysis
CHE 2203 Organic Chemistry I
CHE 2242 Organic Chemistry I Laboratory

2. 3 semester hours minimum in addition to the 3 semester hours required under the General Education Requirements are required in Mathematics:

MAT 1214 Calculus I
or
STA 1993 Statistical Methods for the Life and Social Sciences

3. 8 semester hours are required in Physics:

PHY 1603, 1611 General Physics I and Laboratory
PHY 1623, 1631 General Physics II and Laboratory

C. 12 semester hours of electives, 7 of which must be at the upper-division level.

**UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE
IN MEDICAL TECHNOLOGY**

Certain specific physical skills and abilities are required to successfully participate in the Medical Technology Program. Students may wish to inquire regarding these physical requirements before seeking admission to the program or registering for specific courses in the program.

In the Joint Degree Program, medical technology courses are offered throughout the course of study, culminating in a concentrated clinical hospital experience at the University of Texas Health Science Center at San Antonio. All MEDT courses are taught at the Health Science Center and do not appear in the UTSA semester class schedules.

For consideration for admission into the professional phase of the Joint Degree Program the student must complete a separate application form which may be obtained from the Registrar's Office at The University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284. This application should be submitted by May 15 of the student's sophomore year. Admission to the Joint Degree Program is on a competitive basis. Minimum requirements include 60 hours of college work, an overall GPA of 2.8, completion of at least one medical technology course and laboratory, and no grades lower than C in any basic science or medical technology course. Students will be notified of their status in the professional phase of the program during the summer semester following the sophomore year. The successful applicant

then must complete two regular semesters of academic work before hospital training begins. Admission to the professional phase and successful continuation in the program will provide the student with a clinical training position at the Health Science Center teaching affiliates, Medical Center Hospital and the Audie Murphy Veteran's Administration Hospital.

The Medical Technology Program is accredited by the Committee on Allied Health Education and Accreditation in cooperation with the National Accrediting Agency for clinical laboratory sciences.

Upon successful completion of this joint degree program the student is eligible to take one of the national certification examinations. All students are encouraged to be counseled each semester by either the Medical Technology Program Director or a member of the Medical Technology faculty to ensure enrollment in appropriate course work.

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 143.

All candidates for the degree must complete:

A. 86 semester hours in the major.

1. 21 semester hours are required in the biological sciences.

BIO 1103, 1112	Principles of Biology and Laboratory
BIO 2313	Genetics
BIO 3513, 3522	Biochemistry and Laboratory
BIO 3713, 3722	Microbiology and Laboratory
BIO 4743	Immunology

2. 11 semester hours are required in Allied Health Sciences:

AHS 1883	Introduction to Medical Technology
AHS 3463	Human Physiology
AHS 4783, 4792	Pathogenic Microorganisms and Laboratory

3. *54 semester hours are required in Medical Technology:

a. These courses are taken prior to the hospital clinical rotation:

*MEDT 20351, 20252	Hematology and Laboratory
*MEDT 20301, 20202	Parasitology and Urinalysis and Laboratory
*MEDT 30361, 30262	Immunohematology and Serology and Laboratory
*MEDT 30381, 30282	Clinical Chemistry and Laboratory

b. These courses are the hospital clinical rotation:

*MEDT 40333	Medical Microbiology
*MEDT 40383	Advanced Clinical Chemistry
*MEDT 40353	Advanced Hematology
*MEDT 40355	Advanced Immunohematology and Serology
*MEDT 40587	Chemistry Practicum
*MEDT 40567	Immunohematology Practicum
*MEDT 40557	Hematology Practicum
*MEDT 40537	Microbiology Practicum
*MEDT 40192	Education Techniques for the Medical Technologist
*MEDT 40193	Management Techniques for Medical Technologists

*Courses to be taken at The University of Texas Health Science Center at San Antonio.

UTSA/UTHSC Joint Bachelor of Science Degree in Medical Technology / 187
UTSA/UTHSC Joint Bachelor of Science Degree in Occupational Therapy

B. 21 semester hours of support work.

1. 10 semester hours are required in Chemistry:

CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis
CHE 2203	Organic Chemistry I
CHE 2242	Organic Chemistry I Laboratory

2. 8 semester hours are required in Physics:

PHY 1603, 1611	General Physics I and Laboratory
PHY 1623, 1631	General Physics II and Laboratory

3. 3 semester hours are required in Statistics.

STA 1053	Basic Statistics
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**UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE
IN OCCUPATIONAL THERAPY**

The joint degree program in Occupational Therapy is fully accredited by the Committee on Allied Health Education and Accreditation of the American Medical Association in collaboration with the American Occupational Therapy Association (AOTA). Upon completion of this program, students are eligible to complete the certification examination offered by the AOTA, which is necessary for licensure in Texas.

Admission to the program is made through The University of Texas Health Science Center at San Antonio. Students should seek admission to the professional program only after completing all coursework necessary to meet general education as well as pre-professional (support work) requirements for the program. These may be completed at UTSA or another accredited college or university. However, non-UTSA students must be accepted for admission to The University of Texas at San Antonio prior to application to the professional program. Admission to UTSA does not assure admission to the Occupational Therapy Program. All students are encouraged to be counseled by a member of the occupational therapy faculty to ensure enrollment in appropriate coursework. Appointments or information can be obtained by calling (512-691-7555).

Application for admission to the professional phase of the program must be made by February 1st of the year admission is sought. The application process can be initiated by writing to: Admissions Committee, Occupational Therapy Program, The University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284. Students should assure that they have completed *both* general education as well as pre-professional (support work) requirements prior to making application. It is the responsibility of the application to arrange to have transcripts forwarded to the UTHSC Office of Admissions prior to February 1st of the year in which application is being made.

The minimum number of semester hours required for this degree, including General Education Requirements, is 142.

All candidates for the degree must complete:

A. 93 semester hours in the major.

1. 9 semester hours are required in the biological sciences:

BIO 1103, 1112	Principles of Biology and Lab
BIO 2123, 2131	Comparative Anatomy of Vertebrates and Laboratory
	or
AHS 2083, 2091	Human Biology: Anatomy and Laboratory

**188 / UTSA/UTHSC Joint Bachelor of Science Degree in Occupational Therapy
UTSA/UTHSCSA Joint Bachelor of Science Degree in Physical Therapy**

2. 84 semester hours are required at The University of Texas Health Science Center at San Antonio.*

OCCT 30202	Professional Concepts and Skills
OCCT 30475	Dynamics of Motion
OCCT 30251	Introduction to Research and Evaluation
OCCT 30301	Activity and Health
OCCT 30324	Tools and Activity Processes
OCCT 30331	Occupational Therapy Theory I
OCCT 30391	Occupational Therapy Skills Laboratory I
OCCT 30271	Fieldwork Level I (Physical Disabilities)
OCCT 40332	Occupational Therapy Theory II
OCCT 40392	Occupational Therapy Skills Lab II
OCCT 40325	Design and Fabrication Skills
OCCT 30272	Fieldwork Level I (Psychosocial Dysfunction)
OCCT 40333	Occupational Therapy Theory III
OCCT 40393	Occupational Therapy Skills Lab II
OCCT 40382	Allied Health Management and Consultation
OCCT 40326	Therapeutic Applications of Activity
OCCT 30273	Fieldwork Level I (Pediatrics)
OCCT 40874	Fieldwork Level IIA
CSBL 30816	Human Anatomy
PHYL 30413	Human Physiology
INDT 30471	Human Neurosciences
INDT 30212	Computers in Rehabilitation
PATH 30311	Introductory Pathology
MEDI 30311	Clinical Medicine I
MEDI 40212	Clinical Medicine II
MEDI 40313	Clinical Medicine III

B. 19 semester hours of support work.

- 4 semester hours are required in Chemistry:
CHE 1003, 1111 General Chemistry for Allied Health Sciences
or
CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop
- 9 semester hours are required in Psychology:
PSY 2013 Fundamentals of Psychology
PSY 2503 Developmental Psychology
PSY 2513 Abnormal Psychology
- 3 semester hours are required in Sociology:
SOC 1013 Introduction to the Study of Society
- 3 semester hours are required in Statistics:
STA 1053 Basic Statistics

**UTSA/UTHSCSA JOINT BACHELOR OF SCIENCE DEGREE
IN PHYSICAL THERAPY**

The joint degree Program in Physical Therapy Education is fully accredited by the Committee on Accreditation of the American Physical Therapy Association. Upon

*Courses to be taken at The University of Texas Health Science Center at San Antonio.

UTSA/UTHSCSA Joint Bachelor of Science Degree in Physical Therapy / 189
UTSA/UTHSCSA Program in Physical Therapy Education

completion of this four year program, students are eligible to take the licensure examination offered by the Professional Examination Service, which is required for practice in Texas.

Application to the program must be made by December 15 prior to the summer in which the student wishes to be admitted. This application process can be initiated by writing to:

Allied Health Admissions
The University of Texas Health Science Center
at San Antonio
7703 Floyd Curl Drive
San Antonio, Texas 78284

It should be noted that admission to the Program in Physical Therapy Education is competitive, and admission to UTSA does not guarantee admission into the professional phase of the curriculum.

Each student is expected to complete all General Education Requirements for graduation from UTSA, as well as program prerequisites for Physical Therapy, by June of the year of admission to the professional phase of the Physical Therapy Program. The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 162.

UTSA/UTHSCSA PROGRAM IN PHYSICAL THERAPY EDUCATION

All candidates for the degree must complete 126 semester hours of major and support work.

A. 93 semester hours in the major at the upper division level. *

UTSA/UTHSCSA PROGRAM IN PHYSICAL THERAPY EDUCATION
Curriculum Effective Class Graduating 1988

JUNIOR SUMMER

CSBL 30616	Gross Anatomy	6 credit hours
PHYL 30412	Human Physiology	4 credit hours
PHYT 30313	PT Patient Care & Application	3 credit hours

JUNIOR FALL

INTD 30475	Kinesiology & Application	4 credit hours
INTD 30471	Human Neuroscience	4 credit hours
PHYT 30321	Therapeutic Exercise I & Application	3 credit hours
PHYT 30315	PT Evaluation & Documentation	3 credit hours
PHYT 30335	Physical Agents & Application for PT	3 credit hours
PHYT 30202	Junior Clinical I	2 credit hours

JUNIOR SPRING

MEDI 30311	Clinical Medicine I	3 credit hours
PATH 30411	Pathology	4 credit hours
PHYT 30322	Therapeutic Exercise II & Application	3 credit hours
PHYT 30236	Clin. Electrotherapy & Applic. for PT	2 credit hours
PHYT 30216	Cardiopulmonary Physical Therapy	2 credit hours
PHYT 30208	Orthotics & Prosthetics for PT	2 credit hours
PHYT 30203	Junior Clinical II	2 credit hours

* Courses to be taken at The University of Texas Health Science Center at San Antonio.

190 / UTSA/UTHSCSA Program in Physical Therapy Education
Allied Health Sciences

SENIOR SUMMER

PHYT 40323	Therapeutic Exercise III & Application	3 credit hours
PHYT 40382	Administration & Management for PT	3 credit hours
PHYT 40191	Independent Study for Seniors	1 credit hour
PHYT 40240	Growth & Development for PT	2 credit hours

SENIOR FALL

MEDI 40313	Clinical Medicine III	3 credit hours
PHYT 40294	Physical Therapy Research Methodology	2 credit hours
PHYT 40324	Therapeutic Exercise IV & Application	3 credit hours
PHYT 40337	Rehabilitation Management & Applic.	3 credit hours
PHYT 40671	Senior Clinical I	6 credit hours

SENIOR SPRING

PHYT 41472	Senior Clinical II	14 credit hours
PHYT 40473	Senior Clinical III	4 credit hours

B. 33 semester hours of support work:

1. 4 semester hours of Human or Mammalian Anatomy with lab
AHS 2083 Human Biology: Anatomy
AHS 2091 Human Biology: Anatomy Lab
2. 4 semester hours of Human or Mammalian Physiology with lab
AHS 2103 Human Biology: Physiology
AHS 2111 Human Biology: Physiology Lab
3. 8 semester hours of Chemistry with labs (to include an organic component)
CHE 1003 General Chemistry for AHS
CHE 1111 General Chemistry for AHS Lab
CHE 2103 Elementary Organic and Biochemistry
CHE 2111 Elementary Organic and Biochemistry Lab
4. 8 semester hours of Physics with labs
PHY 1603 General Physics I
PHY 1611 General Physics I Lab
PHY 1623 General Physics II
PHY 1631 General Physics II Lab
5. 3 semester hours of Statistics
STA 1053
6. 3 semester hours of Psychology
PSY 2013
7. 3 semester hours of Sociology
SOC 1013

The UTSA equivalents of these courses are given. Courses completed at another institution that meet the requirements are acceptable.

COURSE DESCRIPTIONS
ALLIED HEALTH SCIENCES
(AHS)

1053 Introductory Microbiology

(3-0) 3 hours credit. Prerequisite: BIO 1103 with BIO 1112 strongly recommended, or BIO 1013, or consent of instructor. May not be applied to a B.S. in Biology. Concurrent enrollment: AHS 1061.

A general study of microorganisms, their characteristics, isolation, growth, and importance in nature, industry, public health and human disease.

1061 Introductory Microbiology Laboratory

(0-3) 1 hour credit.

May not be applied to a B.S. in Biology. Concurrent enrollment: AHS 1053.

1883 Introduction to Medical Technology

(3-0) 3 hours credit. Prerequisite: CHE 1103 is recommended.

Overview of the profession of medical technology including the clinical laboratory and its functions, relationship of physiological and pathological specimens to body systems, and medical terminology and medical laboratory calculations.

2043 Nutrition

(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112; or AHS 2103.

An examination of human nutritional needs from infancy to adulthood.

2083 Human Biology: Anatomy

(3-0) 3 hours credit. Prerequisite: BIO 1103 with BIO 1112 strongly recommended, or BIO 1013 or consent of instructor. Concurrent enrollment: AHS 2091. May not be applied to B.S. in Biology.

The structure of human muscular, skeletal, nervous and organ systems.

2091 Human Biology: Anatomy Laboratory

(0-3) 1 hour credit.

Concurrent enrollment: AHS 2083. May not be applied to a B.S. in Biology.

2103 Human Biology: Physiology

(3-0) 3 hours credit. Prerequisite: BIO 1103 with BIO 1112 strongly recommended, or BIO 1013 or consent of instructor. Concurrent enrollment: AHS 2111. May not be applied to a B.S. in Biology.

Physiological processes in human systems.

2111 Human Biology: Physiology Laboratory

(3-0) 1 hour credit.

Concurrent enrollment: AHS 2103.

3113 Kinesiology

(3-0) 3 hours credit. Prerequisite: AHS 2083 or 2103 or consent of instructor. Primarily designed for students majoring in physical education.

A study of the principles of human motion.

3463 Human Physiology

(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 2103 or 2203 or consent of instructor.

Physiological processes in human systems.

4783 Pathogenic Microorganisms

(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722. Concurrent enrollment: AHS 4792. A consideration of medically important microorganisms and their interaction with animal and human hosts.

4792 Pathogenic Microorganisms Laboratory

(0-6) 2 hours credit.

Concurrent enrollment: AHS 4783.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to a bachelor's degree.

COURSE DESCRIPTIONS

BIOLOGY (BIO)

- 1013 Introduction to Life Sciences**
(3-0) 3 hours credit. May not be applied to a B.S. in Biology.
An introduction to the life sciences emphasizing general principles, diversity of life forms, reproduction and interrelationships between living things. Credit cannot be earned for both BIO 1013 and BIO 1103.
- 1103 Principles of Biology**
(3-0) 3 hours credit. Concurrent enrollment: BIO 1112.
An introduction to living organisms emphasizing fundamentals of organization, reproduction, growth and interrelationships between various forms of life, including a brief survey of the plant and animal groups. Required for students majoring in Biology. Credit cannot be earned for both BIO 1013 and BIO 1103.
- 1112 Principles of Biology Laboratory**
(0-6) 2 hours credit. Concurrent enrollment: BIO 1103.
- 2003 Human Sex and Reproduction**
(3-0) 3 hours credit. Prerequisite: BIO 1013 or 1103 or consent of instructor. May not be applied to a B.S. in Biology.
Human reproductive anatomy and physiology, fertility control, reproductive disease, and parameters influencing fertility patterns.
- 2123 Comparative Anatomy of Vertebrates**
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 2132.
A detailed study of anatomical differences and similarities of vertebrates with reference to evolutionary changes.
- 2132 Comparative Anatomy of Vertebrates Laboratory**
(0-6) 2 hours credit. Concurrent enrollment: BIO 2123.
- 2313 Genetics**
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 1103, and MAT 1013 or equivalent. Concurrent enrollment: BIO 2322.
Principles governing transmission of hereditary factors in plants and animals with emphasis on molecular, biochemical and population genetics.
- 2322 Genetics Laboratory**
(0-6) 2 hours credit. Concurrent enrollment: BIO 2313. Optional for non-majors.
- 3003 Introduction to Oceanography**
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112, or BIO 1013 or consent of instructor.
General oceanography with emphasis on biological aspects and living marine resources.
- 3013 Introductory Pathology**
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112 or BIO 1013 or AHS 2103.
Concepts of disease and diagnosis of pathological conditions.
- 3023 Drugs and Society**
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112, or BIO 1013 or consent of instructor.
An examination of drugs and their biosocial effects.
- 3033 Human Physiology and Performance**
(3-0) 3 hours credit. Prerequisites: BIO 3413 or AHS 2103.
A systematic application of physiological principles to human equipment and space to improve adaptation and performance in the work environment.
- 3063 Invertebrate Biology**
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112.
A course offering the opportunity for a comprehensive study of the invertebrate animals with emphasis on their taxonomy, morphology, ecology, and evolution. Credit cannot be earned for BIO 2063 and BIO 3063.

3083 Biosocial Genetics

(3-0) 3 hours credit. Prerequisite: Consent of instructor.

A study of human heredity and social issues with emphasis on inherited diseases, genetic problems and evolutionary change in relation to culture, diversity and mating systems.

3143 Developmental Biology

(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 3152. Sequential analysis of development in vertebrates and the factors which affect fertilization, organogenesis and implantation.

3152 Developmental Biology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3143.

3163 Histology and Cytology

(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 3172. The cytological and histological aspects of cellular organization.

3172 Histological and Cytological Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3163.

3213 Animal Behavior

(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112.

A detailed study of animal behaviors and their biological determinants.

3273 Biology of Flowering Plants

(2-3) 3 hours credit.

A study of the wild flowers of Texas, emphasizing identification of the more common wild flowers, as well as family characteristics, flower anatomy, and plant morphology. Plant collecting techniques and wild flower photography will be included. Lecture, laboratory and field work will be included as part of the course.

3283 Principles of Ecology

(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112 or consent of instructor. Concurrent enrollment: BIO 3292.

The opportunity to study the interaction of organisms with their environment, ecological principles, adaptations of organisms, environmental pollution and principles of conservation.

3292 Principles of Ecology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3283.

A field-oriented course emphasizing modern ecological techniques, including examinations of plant and animal populations, and measurement of selected chemical and physical parameters.

3323 Evolution

(3-0) 3 hours credit. Prerequisite: BIO 2313.

A discussion of theories and possible mechanisms for evolutionary changes at various levels of organization.

3343 Plant Sciences

(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 3351.

A course offering the opportunity to study the life histories and phylogenetic relationships of vascular and non-vascular plants.

3351 Plant Sciences Laboratory

(0-3) 1 hour credit. Concurrent enrollment: BIO 3343.

3413 General Physiology

(3-0) 3 hours credit. Prerequisites: BIO 1103, CHE 2003 and PHY 1623; recommended: MAT 1093. Concurrent enrollment: BIO 3422.

Fundamental properties and processes in living systems.

3422 General Physiology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3413.

3513 Biochemistry

(3-0) 3 hours credit. Prerequisites: CHE 2203, 2242; BIO 2313 recommended. Concurrent enrollment: BIO 3522.

Introduction to biochemistry; amino acids; protein structures; enzyme action; lipids and saccharides; metabolism; nucleic acids and molecular biology.

3522 Biochemistry Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3513.

Basic biochemical laboratory techniques: titration, protein purification, enzyme kinetics, chromatography, electrophoresis and centrifugation.

3533 Radiation Biology

(3-0) 3 hours credit. Prerequisites: BIO 2313 and 3713 or consent of instructor.

A study of the biological effects of ionizing and non-ionizing radiation and cellular repair of radiation damage.

3542 Radiation Biology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3533.

3633 Human Environmental Physiology

(3-0) 3 hours credit. Prerequisites: BIO 3413 or AHS 2103.

Adaptive physiological responses to unusual environmental conditions.

3713 Microbiology

(3-0) 3 hours credit. Prerequisites: BIO 2313 and CHE 2203. Concurrent enrollment: BIO 3722.

A comprehensive study of microorganisms including their composition, morphology, growth, metabolism, classification, ecology and significance in disease.

3722 Microbiology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3713.

3733 Industrial Microbiology

(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722.

A study of genetic engineering of industrial microorganisms, industrial fermentation methodologies, quality control, and biotransformations used for the microbial manufacture of foods, beverages, antibiotics, enzymes, single-cell proteins and industrial chemicals.

3813 Cellular Biology

(3-0) 3 hours credit. Prerequisite: BIO 3413 or 3513. Concurrent enrollment: BIO 3822. A study of cellular function with relation to structure from the microscopic to molecular level.

3822 Cellular Biology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 3813.

4023 Environmental Toxicology

(3-0) 3 hours credit. Prerequisite: BIO 3413 or 3513.

Environmental toxicants will be studied in terms of bioavailability, bioaccumulation, biodegradation; toxicity and physiological processes.

4043 Desert Biology

(2-3) 3 hours credit. Prerequisites: BIO 3283 and 3292.

A study of the deserts of the world with an emphasis on U.S. deserts. Adaptations of plants and animals and their responses to desert conditions will be included, as well as examinations of desert climatic patterns, geology, and natural history. Lecture, laboratory and field work will be included.

4073 Law, Ethics and the Life Sciences

(3-0) 3 hours credit. Prerequisites: BIO 1013 or BIO 1103 and 1112, or consent of instructor.

Current developments in biology such as recombinant DNA, embryo transplants, life preserving processes, reproductive and population control, and the impact of biotechnology on enactment of new legislation and ethics in general.

4203 Plant Ecology

(3-0) 3 hours credit. Prerequisite: BIO 3283, 3292, or consent of instructor. Concurrent enrollment: BIO 4221.

A study of the major biomes of North America and Texas, including the chemical, physical and biological factors that influence the development of these biomes.

- 4221 Plant Ecology Laboratory**
(0-3) 1 hour credit. Concurrent enrollment: BIO 4203.
A course providing the opportunity for field-oriented study to examine qualitative and quantitative methods to evaluate plant communities.
- 4233 Field Biology**
(3-0) 3 hours credit. Prerequisites: BIO 1013, or BIO 1103 and 1112, or consent of instructor. Concurrent enrollment: BIO 4241.
A study of the natural history of plants and animals in their native environment. Techniques for the identification of birds, mammals, reptiles, amphibians, insects, and the dominant flowering plants will be discussed.
- 4241 Field Biology Laboratory**
(0-3) 1 hour credit. Concurrent enrollment: BIO 4233.
A field-oriented course offering the opportunity for practical experience observing, collecting and identifying Texas plants and animals.
- 4333 Population Genetics**
(3-0) 3 hours credit. Prerequisites: BIO 2313 and 2322.
A quantitative approach to the study of genetics systems in populations, including mutations, selection, polymorphism and mating systems.
- 4343 Molecular Genetics**
(3-0) 3 hours credit. Prerequisites: BIO 2313, 2322, 3513 and 3522.
Molecular approach to structure, replication, mutation and phenotypic expression of genetic material.
- 4353 Comparative Animal Physiology**
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422.
A phylogenetic study of physiologic adaptation in animals.
- 4433 Neurobiology**
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422.
Anatomy and physiology of nervous systems, the mechanisms of neuronal functions.
- 4442 Neurobiology Laboratory**
(0-6) 2 hours credit. Concurrent enrollment: BIO 4433.
A laboratory course emphasizing principles presented in BIO 4433.
- 4453 Endocrinology**
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422, 3513 and 3522.
A consideration of the physiological effects of hormones on the organism in health and disease, together with a study of the gross and microscopic morphology of the glands of internal secretion.
- 4462 Endocrinology Laboratory**
(0-6) 2 hours credit. Concurrent enrollment: BIO 4453.
A laboratory course emphasizing principles presented in BIO 4453.
- 4523 Intermediary Metabolism**
(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522.
A detailed consideration of metabolic pathways, energy metabolism and their regulation.
- 4603 Plant Physiology**
(3-0) 3 hours credit. Prerequisites: BIO 3343, 3351, CHE 2203 and 2242. Concurrent enrollment: BIO 4611.
Principles of organization of cellular activity and molecular structure of protoplasm: nutrition, translocation, mineral metabolism, respiration and photosynthesis.
- 4611 Plant Physiology Laboratory**
(0-3) 1 hour credit. Concurrent enrollment: BIO 4603.
A course providing qualitative and quantitative experiments in the study of plant physiology.
- 4723 Virology**
(3-0) 3 hours credit. Prerequisite: BIO 3713.
A study of the diversity of viruses and biochemical mechanisms for their replication.

4731 Virology Laboratory

(0-3) 1 hour credit. Concurrent enrollment: BIO 4723.

4743 Immunology

(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522, or 3713 and 3722.

A study of the properties of antigens and antibodies, current concepts of humoral and cell-mediated immunity and the cells involved.

4752 Immunology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 4743.

4763 Parasitology

(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722. Concurrent enrollment: BIO 4772.

A study of the animal parasites of humans and related hosts with emphasis on their epidemiology, life cycles, pathology and control.

4772 Parasitology Laboratory

(0-6) 2 hours credit. Concurrent enrollment: BIO 4763.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the bachelor's degree.

4951-3 Special Studies in Biology

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4963 Seminar in Biology

(3-0) 3 hours credit. Prerequisite: Junior or senior standing with a minimum of 20 hours in biological sciences.

An undergraduate seminar limited to biology majors, which provides an opportunity to survey selected biological topics through presentation and discussion of relevant contemporary research and literature. May not be repeated for credit.

4993 Honors Research

3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during their last two semesters; approval by the College Honors Committee.

Supervised research and preparation of an honors thesis. May be repeated once with approval.

DIVISION OF MATHEMATICS, COMPUTER SCIENCE, AND SYSTEMS DESIGN

The division offers a Bachelor of Science Degree in Computer Science and Systems Design in which the student may select a concentration in Computer Science or a concentration in Systems Design. The division also offers a Bachelor of Science Degree in Mathematics in which the student may select a concentration in Mathematics, a concentration in Statistics or a concentration in Mathematics Education.

BACHELOR OF SCIENCE DEGREE IN COMPUTER SCIENCE AND SYSTEMS DESIGN

The Bachelor of Science Degree in Computer Science and Systems Design is offered with two concentrations:

Concentration 1.	Computer Science
Concentration 2.	Systems Design

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 126.

All majors in computer science and systems design are required to complete with a grade of C or better any lower-division CS and SD courses (CS 1711, 1713, 1723, 2733, 2743, SD 2812, 2813) which are prerequisites for other lower- and upper-division courses prior to enrolling in those respective courses.

All candidates for the Bachelor of Science degree in Computer Science and Systems Design, regardless of concentration, must complete the following 51 semester hours of required courses (which includes the 9 hours of General Education Requirements in Sciences and Engineering).

The student who is not prepared to begin MAT 1214 must take MAT 1093, Pre-calculus or MAT 1153, Analytic Geometry.

CS	1711	Introduction to Computer Science Laboratory
CS	1713	Introduction to Computer Science
CS	1723	Data Structures I
CS	2733	Introduction to Computer Organization
CS	2743	Data Structures II
CS	3733	Operating Systems
CS	4753	Computer Architecture
SD	2812	Digital Circuits Design I Laboratory
SD	2813	Digital Circuits Design I
MAT	1214	Calculus I
MAT	1223	Calculus II
MAT	2213	Calculus III
MAT	2233	Linear Algebra
STA	3513	Probability and Statistics
STA	3523	Statistical Methods
ENG	2413	Technical Writing
PHY	1904	Technical Physics I
PHY	1911	Technical Physics I Laboratory

In addition, a candidate for the Bachelor of Science in Computer Science and Systems Design degree must complete the course requirements for one of the concentrations declared by the candidate.

1. Concentration in Computer Science (software option)

**198 / Bachelor of Science Degree in Computer Science and Systems Design
Bachelor of Science Degree in Mathematics**

- A. Required courses: 15 semester hours.
 - CS 3233 Discrete Mathematical Structures
 - CS 3723 Programming Languages
 - CS 3743 Data Base Management
 - CS 3773 Programming Methodology
 - MAT 2243 Foundations of Mathematics
 - B. An additional 9 semester hours of upper division courses in the Division of Mathematics, Computer Science, and Systems Design.
 - C. Electives, 18 semester hours.
2. Concentration in Systems Design (hardware option)
- A. Required courses: 17 semester hours.
 - MAT 3613 Differential Equations I
 - SD 3812 Digital Circuits Design II Laboratory
 - SD 3813 Digital Circuits Design II
 - SD 4803 Microprocessor Laboratory I
 - SD 4843 Real Time Digital Control
 - SD 4853 Computer Interfaces
 - B. An additional 6 semester hours of upper division courses in CS or SD.
 - C. Electives, 19 semester hours.

BACHELOR OF SCIENCE DEGREE IN MATHEMATICS

The Bachelor of Science Degree in Mathematics is offered with three concentrations:

Concentration 1.	Mathematics
Concentration 2.	Statistics
Concentration 3.	Mathematics Education

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 126¹³. Students choosing Concentration 3, should satisfy the General Education Requirements consistent with the Texas Certification Program.

All candidates for the Bachelor of Science degree in Mathematics, regardless of concentration, must complete the following 32 semester hours of required courses (which may include the 6 hours of General Education Requirements in Sciences and Engineering).

The student who is not prepared to begin MAT 1214 must take MAT 1093, Pre-calculus or MAT 1153, Analytic Geometry.

- MAT 1214 Calculus I
- MAT 1223 Calculus II
- MAT 2213 Calculus III
- MAT 2233 Linear Algebra
- MAT 2243 Foundations of Mathematics
- MAT 3213 Foundations of Analysis
- STA 3513 Probability and Statistics
- STA 3523 Statistical Methods
- CS 1711 Introduction to Computer Science Laboratory
- CS 1713 Introduction to Computer Science
- CS 1723 Data Structures I

¹³Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

Students seeking teacher certification should consult the Undergraduate Certificate Programs in Education brochure for information.

In addition, a candidate for the Bachelor of Science in Mathematics degree must complete the course requirements for the concentration declared by the candidate.

1. Concentration in Mathematics

A. Required Courses: 21 semester hours.

- MAT 3223 Complex Variables
- MAT 3243 Calculus for Application
- MAT 3613 Differential Equation I
- MAT 3633 Numerical Analysis I
- MAT 4213 Real Analysis I
- MAT 4223 Real Analysis II
- MAT 4233 Modern Abstract Algebra I

B. An additional 9 semester hours of upper division courses in the Division of Mathematics, Computer Science, and Systems Design.

C. Electives, 28 semester hours.

2. Concentration in Statistics

A. Required Courses: 21 semester hours.

- MAT 3633 Numerical Analysis I
- MAT 4213 Real Analysis I
- STA 3013 Multivariate Analysis for the Life and Social Sciences
- STA 3433 Applied Non-Parametric Statistics
- STA 4643 Introduction to Stochastic Processes
- STA 4713 Applied Regression Analysis
- STA 4723 Design and Analysis of Experiments

B. 9 additional hours of approved courses in the Division of which 3 hours may be in the 2000 level. The other 6 hours must be at the 3000 level or above.

C. Electives, 28 semester hours.

3. Concentration in Mathematics Education.

A. Required Courses in Mathematics: 12 semester hours

- MAT 3233 Modern Algebra
- MAT 4263 Geometry

Any 6 approved semester hours in MAT with a course number of 3000 or above.

B. Required Academic Foundations: 7 semester hours.

- COM 1043 Introduction to Communication
- Three semester hours of English elective

One hour science lab associated with science course taken to fulfill general education requirements.

C. Required Courses in Professional Education (24 hours).

- C&I 3003 The Secondary School Curriculum
- EDP 3003 Introduction to Educational Psychology
- EDU 3003 Educational Sociology
- EDU 3013 The School Environment and Learning Resources
- EDU 4093 Teaching in the Secondary School
- EDU 4049 Student Teaching: Secondary

or

EDU 4059 Student Teaching: Secondary-ESL

NOTE: C&I 3003, EDP 3003, EDU 3003 and EDU 3013 must be completed prior to the student teaching semester. EDU 4093 and EDU 4049 or 4059 comprise the Education Professional Semester and Student Teaching. Students must apply to student teach one semester in advance. For complete information on all requirements, contact the Director of Student Teaching.

D. Electives: 15 semester hours

NOTE: Individuals pursuing teaching certification may use the electives to fulfill partially the requirements for a Texas Teacher's Certificate. Students should consult the "Undergraduate Certification Programs in Education" brochure for complete information. In addition to specific course requirements, teacher certification in Texas also requires passing scores on the Pre-Professional Skills Test (PPST), and, effective May 1, 1986, acceptable scores on the state-mandated exit competency test. Complete information on all requirements may be obtained at the Office of Teacher Certification and Placement at UTSA.

COURSE DESCRIPTIONS

COMPUTER SCIENCE (CS)

1043 Computer Programming for Business Applications

(3-0) 3 hours credit. Prerequisite: MAT 1033.

An introduction to computers and programming in the business professions. Topics will be practical in nature and include solutions to equations, searching and sorting, inventory control, table look-up, and the vocabulary involved in working with computer professionals. May not be applied toward a major in the Division of Mathematics, Computer Science, and Systems Design.

1073 Introductory Computer Programming for Scientific Applications

(3-0) 3 hours credit. Prerequisite: MAT 1063.

Introductory programming. Sorting and ranking; plotting; numerical taxonomy. Solution of non-linear equations; linear regression. Solution of linear systems. May not be applied toward a major in the Division of Mathematics, Computer Science and Systems Design.

1711 Introduction to Computer Science Laboratory

(0-2) 1 hour credit. Prerequisite or concurrent enrollment: MAT 1214. Concurrent enrollment: CS 1713.

Laboratory to accompany CS 1713.

1713 Introduction to Computer Science

(3-0) 3 hours credit. Prerequisite or concurrent enrollment: MAT 1214. Concurrent enrollment: CS 1711.

Introduction to basic concepts of computer science. Functional components of computers, data representation, problem solving methods, algorithm development, and programming using a high-level programming language.

1723 Data Structures I

(3-0) 3 hours credit. Prerequisites: CS 1711, CS 1713 and MAT 1214.

Abstract data structures (stacks, queues, lists, trees), primitive operations, and methods of data representation. Based variables, pointers, and recursion.

2033 Fundamentals of Computer Concepts I

(3-0) 3 hours credit. Prerequisites: Sophomore or higher classification. Credit cannot be earned for both CS 1043 and CS 2033.

An introduction to computers and information processing for those with no previous background; a study of the computer, its uses and social impact; introduction to computer

programming. May not be applied towards a major in the Division of Mathematics, Computer Science, and Systems Design.

2073 Computer Programming With Engineering Applications

(3-0) 3 hours credit. Prerequisite: MAT 1214. Prerequisite or Corequisite: MAT 1223. Algorithmic approaches to problem solving and computer program design for engineers. Engineering and mathematically-oriented problem sets will be emphasized, including non-numeric applications. Searching, sorting, linked-lists, and data typing will be introduced. May not be applied towards a major in the Division of Mathematics, Computer Science, and Systems Design.

2083 Microcomputer Programming For Teachers

(3-0) 3 hours credit. Prerequisite: consent of instructor. An introduction to the uses of microcomputers. Students will investigate instructional uses of the computer in the classroom and will write their own computer-generated instructional materials. Instruction will be in the BASIC programming language. May not be applied towards a major in the Division of Mathematics, Computer Science, and Systems Design other than the Mathematics Education concentration.

2133 Fundamentals of Computer Concepts II

(3-0) 3 hours credit. Prerequisite: CS 2033. Advanced programming topics in BASIC; special emphasis on microcomputers in home and business applications. May not be applied towards a major in the Division of Mathematics, Computer Science, and Systems Design.

2733 Introduction to Computer Organization

(3-0) 3 hours credit. Prerequisite: CS 1723. Introduction to computer organization with focus on the assembly level, the conventional machine level, and the microprogramming level.

2743 Data Structures II

(3-0) 3 hours credit. Prerequisite: CS 1723. Graphs, searching, sorting, storage device characteristics, file organizations, file access methods and memory management.

3073 Computer Graphics and Numerical Techniques.

(3-0) 3 hours credit. Prerequisites: CS 2073 and MAT 3253. Computer graphics, numerical analysis, and advanced programming techniques with applications to engineering problems. May not be applied towards a major in the Division of Mathematics, Computer Science, and Systems Design.

3133 Computers and Society

(3-0) 3 hours credit. Prerequisite: Any one of the following courses: CS 1043, 1073, 1713, 2033, 2073 or consent of instructor. Examination of some of the major issues faced by the use of computers in society including computers and the law, computers in business, computers in education, computers in science and engineering, and electronic fund-transfer and communications.

3233 Discrete Mathematical Structures

(3-0) 3 hours credit. Prerequisites: CS 1723, MAT 2233 and MAT 2243. Survey and development of theoretical tools suitable for describing algorithmic applications. Propositional and predicate calculus, induction, proofs, set theory, finite state automata, and boolean algebra.

3321 Topics in Programming Languages

(1-0) 1 hour credit. Prerequisite: CS 2743. Problem solving techniques and constructs in a particular language. Languages will vary and may include COBOL, FORTRAN, PL/I, LISP, SNOBOL, PASCAL, ADA, PROLOG, MODULA 2 and various assembly languages. May be repeated for credit when topics vary, but not more than 3 hours will apply to the major.

3723 Programming Languages

(3-0) 3 hours credit. Prerequisites: CS 2733, CS 2743, and MAT 2213. An introduction to the philosophy and features of high-level programming language families; elementary aspects of computer and run-time considerations, problem solving ability, syntax, and examples. Students will write programs in several language families.

3733 Operating Systems

(3-0) 3 hours credit. Prerequisites: CS 2733, CS 2743, and MAT 2213.

An introduction to the functions and major techniques of a modern multi-programming operating system. Includes exposure to the fundamentals of processor management process synchronization, memory management, and peripheral management.

3743 Data Base Management

(3-0) 3 hours credit. Prerequisites: CS 2743 and MAT 2213.

Study of systems for management of large amounts of related data. Basic concepts implementation approaches, user data models, commercially available systems.

3773 Programming Methodology

(3-0) 3 hours credit. Prerequisites: CS 2733, CS 2743, and MAT 2213.

Software development (analysis, specifications, design, implementation and testing). Design methodologies and programming standards. Development project in small groups including acceptance test.

3793 Introduction to Artificial Intelligence

(3-0) 3 hours credit. Prerequisites: CS 2743 and 3233 and a knowledge of LISP.

Discussion of theorem proving by machine, computational linguistics, psychological modeling and computer games.

4133 Survey of Computer System Concepts

(3-0) 3 hours credit. Prerequisite: Programming experience or familiarity with the basics of computing.

A survey of some essential concepts of information structures and file systems, operating systems, programming languages, and architecture from a user's point of view. May not be applied to a major in the Division of Mathematics, Computer Science and Systems Design.

4313 Automata, Computability and Formal Languages

(3-0) 3 hours credit. Prerequisite: CS 3233.

Discussion of abstract machines (finite state automata, pushdown automata and Turing machines), formal grammars (regular, context-free and type 0) and the relationships among them.

4323 Analysis of Algorithms

(3-0) 3 hours credit. Prerequisites: CS 2743 and CS 3233.

Analysis of the performance of algorithms and discussion of programming techniques and data structures used in the writing of effective algorithms.

4383 Computer Graphics

(3-0) 3 hours credit. Prerequisites: CS 2743 and MAT 2233.

An introduction to two- and three-dimensional generative computer graphics. Display devices, data structures, mathematical transformations, and algorithms used in picture generation, manipulation, and display.

4633 Simulation

(3-0) 3 hours credit. Prerequisites: CS 1723 and STA 3513.

Construction and use of simulation models on a digital computer. Monte Carlo techniques and associated statistical methods.

4713 Compiler Writing

(3-0) 3 hours credit. Prerequisite: CS 3723.

An introduction to implementation of translators. Topics include formal grammars, scanners, parsing techniques, symbol table management, code generation, and code optimization.

4753 Computer Architecture

(3-0) 3 hours credit. Prerequisite: SD 2813. Prerequisite or concurrent enrollment: CS 3733.

An investigation of the major concepts of computer architecture including the central processing unit, main memory, and peripheral devices.

COURSE DESCRIPTIONS
MATHEMATICS
(MAT)

- 1013 Algebra**
(3-0) 3 hours credit.
Real numbers, linear equations and inequalities, absolute inequalities, factorization of polynomials, rational expressions, negative and rational exponents, scientific notation, radicals, quadratic equations and inequalities, cartesian coordinates, relations, functions and graphing of functions.
- 1033 Algebra with Calculus for Business**
(3-0) 3 hours credit. Prerequisite: MAT 1013 or the equivalent.
An introduction to business calculus with an emphasis on the algebra of functions. Concentration is on the algebraic manipulations of functions and includes volume and profit functions, both linear and quadratic; root finding and graphical analysis; differentiation and integration.
- 1063 Algebra for Scientists and Engineers**
(3-0) 3 hours credit.
Algebraic expressions; equations, inequalities over the real numbers, relations, functions; polynomial and rational functions; systems of linear equations and inequalities; matrices and determinants; complex numbers; polynomials, sequences, series, binomial expansion; mathematical induction; permutations, combinations.
- 1093 Precalculus**
(3-0) 3 hours credit. Prerequisite: MAT 1063.
Exponential functions, logarithmic functions, trigonometric functions, complex numbers, De Moivre's Theorem, polar coordinates.
- 1143 Essential Elements in Mathematics**
(3-0) 3 hours credit. Prerequisite: MAT 1013.
Numeration systems; properties of the systems of whole numbers, integers, rational numbers, and real numbers; problem solving, geometry and measurement; probability and statistics; logic. Applies only to elementary teacher certification requirements.
- 1153 Analytic Geometry**
(3-0) 3 hours credit. Prerequisite: MAT 1093.
Vectors; equations of straight lines; equations of planes; conic sections; circles, ellipses, parabolas, hyperbolas; translation of axes, rotation of axes; polar coordinates; quadratic surfaces.
- 1214 Calculus I**
(4-0) 4 hours credit. Prerequisite: MAT 1093 or MAT 1153.
An introduction to the concepts of limit, continuity and derivative, mean value theorem, and applications of derivatives such as velocity, acceleration, maximization and curve sketching; introduction to the Riemann integral and the fundamental theorem of calculus.
- 1223 Calculus II**
(3-0) 3 hours credit. Prerequisite: MAT 1214.
Methods of integration, inverse trigonometric functions, applications of the integral, multiple integrals.
- 2213 Calculus III**
(3-0) 3 hours credit. Prerequisite: MAT 1223.
Special areas of differential and integral calculus. Taylor series, power series, convergence tests, vectors, functions of several variables, partial derivatives.
- 2233 Linear Algebra**
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Vector spaces and matrix algebra, matrices and determinants, characteristic values of matrices and reduction to canonical forms. Emphasis on applications.
- 2243 Foundations of Mathematics**
(3-0) 3 hours credit. Prerequisite: MAT 1214.

Development of theoretical tools for rigorous mathematics. Topics may include; mathematical logic, propositional and predicate calculus, set theory, functions and relations, cardinal and ordinal numbers, Boolean algebras, and construction of the natural numbers, integers and rational numbers. Emphasis on theorem proving.

3113 Algebra for Elementary Teachers

(3-0) 3 hours credit. Prerequisite: MAT 1143.

Areas of study from college algebra including linear and quadratic equations and inequalities, systems of equations, graphical methods. Open only to declared Elementary Education majors.

3123 Geometry for Elementary Teachers

(3-0) 3 hours credit. Prerequisite: MAT 1143.

A survey course encompassing topics from plane geometry, including an axiomatic development of proofs, coordinate geometry, non-euclidean geometry, 3-dimensional geometry and topology. Open only to declared Elementary Education majors.

3213 Foundations of Analysis

(3-0) 3 hours credit. Prerequisites: MAT 2213 and MAT 2243.

An opportunity for rigorous development of the foundations of real analysis; basic point set topology in \mathbb{R}^1 and \mathbb{R}^n , compactness; connectedness; convergence; cardinality. Emphasis on theorem proving and mathematical rigor.

3223 Complex Variables

(3-0) 3 hours credit. Prerequisite: MAT 2213.

An introduction to complex variables including elementary functions, line integrals, power series, residues and poles and conformal mappings.

3233 Modern Algebra

(3-0) 3 hours credit. Prerequisite: MAT 2213.

An introduction to the concepts of modern algebra by way of the integers. Emphasis on theorem proving and mathematical rigor.

3243 Calculus for Applications

(3-0) 3 hours credit. Prerequisite: MAT 2233.

Line vector differential and integral calculus, line integrals, Green's theorem, Stokes' theorem, Divergence theorem.

3253 Engineering Analysis I

(3-0) 3 hours credit. Prerequisite: MAT 2213.

Ordinary differential equations, Laplace transforms, linear algebra and matrix arithmetic. May not be applied to a major in the Division of Mathematics, Computer Science and Systems Design.

3263 Engineering Analysis II

(3-0) 3 hours credit. Prerequisite: MAT 3253.

Fourier series, partial differential equations and vector calculus. Topics from linear difference equations, Z-transforms and complex analysis. May not be applied to a major in the Division of Mathematics, Computer Science and Systems Design.

3613 Differential Equations I

(3-0) 3 hours credit. Prerequisite or concurrent enrollment in MAT 2233.

Basic notions of differential equations, solution of first order equations and linear equations with constant coefficients, n^{th} order initial value problems, power series solutions of differential equations.

3623 Differential Equations II

(3-0) 3 hours credit. Prerequisite: MAT 3613.

Continuation of MAT 3613. Stability, partial differential equations and boundary value problems.

3633 Numerical Analysis I

(3-0) 3 hours credit. Prerequisites: MAT 2233 and either CS 1073 or 1713.

Solution of linear and non-linear equations, curve-fitting, eigenvalue problems.

3923 Finance Mathematics

(3-0) 3 hours credit. Prerequisite: MAT 1214.

Analysis of the time value of money; preparation for parts of the actuarial examinations; determining the evaluation of flows of money, mortgage payments, bond amortization schedules, annuities, and related areas.

3933 Mathematics of Life Insurance

(3-0) 3 hours credit. Prerequisite: STA 3513.

Probability theory applied to problems of life insurance. Measurement of mortality; annuity and insurance benefits; reserve liabilities; expenses; gross premiums, asset shares, modified reserves, cash values; nonforfeiture options; distribution of surplus.

4113 Mathematical Subjects for Elementary Teachers

(3-0) 3 hours credit. Prerequisite: MAT 3113.

Selected mathematical subjects of an advanced nature relevant to the modern elementary mathematics curriculum. Open only to declared Elementary Education majors.

4123 History of Mathematics for Teachers

(3-0) 3 hours credit. Prerequisite: MAT 3113.

Selected subjects in mathematics developed through historical perspectives and biographies. Open only to preservice and inservice teachers.

4213 Real Analysis I

(3-0) 3 hours credit. Prerequisite: MAT 3213 recommended.

An in-depth study of the calculus of functions of a single real variable; pointwise convergence; continuity; uniform convergence; differentiation; functions of bounded variation; Riemann-Stieltjes integration; interchange of limits.

4223 Real Analysis II

(3-0) 3 hours credit. Prerequisites: MAT 2233 and 4213.

An in-depth study of the calculus of functions of several real variables; differentiation; Jacobians; non-linear transformations; integration.

4233 Modern Abstract Algebra I

(3-0) 3 hours credit. Prerequisites: MAT 2233 and MAT 2243.

An in-depth study of groups and rings.

4253 Number Theory

(3-0) 3 hours credit. Prerequisites: MAT 2213 and MAT 2243.

The theory of primes, congruences and related subjects.

4263 Geometry

(3-0) 3 hours credit. Prerequisites: MAT 2213 and MAT 2243.

Projective, affine and non-Euclidean geometry.

4273 Topology

(3-0) 3 hours credit. Prerequisites: MAT 2213 and MAT 2243.

Set theory including cardinal and ordinal numbers. Topological properties of the real line and metric spaces.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's Advisor, and the Division Director and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours will apply to the bachelor's degree.

4951-3 Special Studies in Mathematics

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research

3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during the last two semesters; approval by the College Honors Committee.

Supervised research and preparation of an honors thesis. May be repeated one time only with approval.

COURSE DESCRIPTIONS

STATISTICS (STA)

1053 Basic Statistics

(3-0) 3 hours credit. Prerequisite: MAT 1013, 1033 or 1063.

Descriptive statistics: histograms, measures of location and dispersion. Elementary probability theory. Random variables. Binomial and normal distributions. Interval estimation and hypothesis testing. Simple linear regression and correlation. Applications of the chi-square distribution.

1064 Basic Statistics for Business and Economics

(4-0) 4 hours credit. Prerequisite: MAT 1033.

Fundamental concepts and procedures of statistics and probability with business applications: descriptive and inferential statistics, regression and correlation, time series, index numbers. Use of computer library programs.

1073 Statistics for Psychology

(3-0) 3 hours credit. Prerequisites: MAT 1013 and one PSY course.

The use of statistics in psychological research. Elementary probability theory. Descriptive statistics including histograms, graphing, and measures of central tendency and dispersion. Correlational techniques. Binomial and normal distributions. Inferential statistics including hypothesis testing, interval estimation, and analysis of variance.

1993 Statistical Methods for the Life and Social Sciences

(3-0) 3 hours credit. Prerequisite: STA 1053 or 1064.

Point estimator properties, inference about the means and variances of two or more populations, categorical data analysis, linear regression, analysis of variance, nonparametric tests. Open to students of all disciplines.

3013 Multivariate Analysis for the Life and Social Sciences

(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.

Linear algebra preliminaries, the multivariate normal distribution, tests on means, discrimination analysis, cluster analysis, principal components, factor analysis. Use of computer library programs. Open to students of all disciplines.

3313 Introduction to Sample Survey Theory and Methods

(3-0) 3 hours credit. Prerequisite: STA 1993 or 3513.

Basic tools, simple random sampling, stratified random sampling, ratio and regression estimates, systematic sampling, cluster sampling, unequal probability sampling, two-stage and multistage sampling, non-sampling errors.

3433 Applied Non-Parametric Statistics

(3-0) 3 hours credit. Prerequisite: STA 1993 or concurrent enrollment; STA 3523.

Tests of location. Goodness of fit tests. Rank tests. Tests based on nominal and ordinal data for both related and independent samples. Measures of association.

3513 Probability and Statistics

(3-0) 3 hours credit. Prerequisite or concurrent enrollment; MAT 2213.

Axioms of probability, probability functions and density functions, random variables, functions of random variables and their sampling distributions.

3523 Statistical Methods

(3-0) 3 hours credit. Prerequisite: STA 3513.

Estimation and testing hypotheses, chi-square tests, linear regression, quality control, reliability, queueing theory, and nonparametric methods.

3533 Probability and Random Processes

(3-0) 3 hours credit. Prerequisites: EE 3423 and MAT 3263.

Probability; random variables, distribution and density functions, limit theorems; random processes, correlation functions, power spectra; response of linear systems to random inputs.

3813 Discrete Data Analysis and Bioassay

(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.

Methods especially useful for problems arising in the life sciences. Analysis of count data. Contingency tables. Probit analysis.

4643 Introduction to Stochastic Processes

(3-0) 3 hours credit. Prerequisite: STA 3513.

Finite Markov chains including transition probabilities, classification of states, limit theorems; queuing theory, birth and death processes.

4713 Applied Regression Analysis

(3-0) 3 hours credit. Prerequisite: STA 1993 or 3513.

An introduction to regression analysis with emphasis on practical aspects, fitting a straight line, examination of residuals, matrix treatment of regression analysis, fitting and evaluation of general linear models, non-linear regression.

4723 Design and Analysis of Experiments

(3-0) 3 hours credit. Prerequisite: STA 1993; or concurrent enrollment: STA 3523.

General concepts in the design and analysis of experiments; response variable, factors to be varied, quantitative and qualitative factors, fixed and random factors and how the factors are to be combined. The method of randomization to be used in the design, the order of experimentation, the mathematical model used to describe the experiment, computation of the test statistics and the interpretation of the results.

4803 Statistical Quality Control

(3-0) 3 hours credit. Prerequisite: STA 3513.

Statistics and simple probability are introduced in terms of problems which arise in manufacturing; their application to control of manufacturing processes. Acceptance sampling in terms of standard sampling plans: MIL-STD 105, MIL-STD 414, Dodge-Romig plans, continuous plans, etc.

4903 Survival Analysis

(3-0) 3 hours credit. Prerequisite: STA 3513 or equivalent.

Measures of reliability, hazard function, mean residual life function. Common failure distributions and a procedure for selecting an appropriate model. Reliability of complex series and parallel systems. Probabilistic approach to biomedical applications.

4951-3 Special Studies in Statistics

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

COURSE DESCRIPTIONS
SYSTEMS DESIGN
(SD)

2812 Digital Circuits Design I Laboratory

(0-4) 2 hours credit. Prerequisite: Concurrent enrollment in SD 2813.

Laboratory to accompany SD 2813.

2813 Digital Circuits Design I

(3-0) 3 hours credit. Prerequisites: CS 1723 and MAT 1214, concurrent enrollment: SD 2812.

An introduction to modern integrated digital computer circuits. Boolean algebra. Karnaugh maps. Combinational network design. Flip-flops and counters. Sequential networks.

3812 Digital Circuits Design II Laboratory

(0-4) 2 hours credit. Concurrent enrollment: SD 3813.

Laboratory to accompany SD 3813.

3813 Digital Circuits Design II

(3-0) 3 hours credit. Prerequisite: SD 2813; concurrent enrollment: SD 3812.

A continuation of SD 2813. Advanced design techniques using MSI and LSI circuits.

3823 Data Acquisition and Distribution

(2-2) 3 hours credit. Prerequisite: CS 2073.

Fundamentals of assembly language for a microcomputer. Programming techniques used to interface a microcomputer to scientific laboratory instrumentation. Analog and digital data formats and characteristics. May not be applied towards a major in the Division of Mathematics, Computer Science, and Systems Design.

3843 Small Systems Architecture and Interfacing

(2-2) 3 hours credit. Prerequisites: CS 2733, SD 2813, SD 2812.

Programming techniques used to interface minicomputers and microcomputers to scientific laboratory instrumentation. Analog and digital data formats and characteristics. Hardware organization and systems architecture of state-of-the-art minicomputer systems.

3853 Instrumentation Circuits Design

(3-0) 3 hours credit. Prerequisites: SD 2812, 2813, and PHY 1924.

Functional characteristics of state-of-the-art integrated operational amplifiers, regulated power supplies, digital-to-analog and analog-to-digital converters, isolation amplifiers, serial transmitters, design of hardware configurations to interface scientific and industrial instrumentation to a minicomputer.

4613 Operations Research I

(3-0) 3 hours credit. Prerequisite: MAT 2213 and MAT 2233.

Introduction to analytical methods and models of operations research, with emphasis on optimization. Linear, integer and non-linear programming. Network analysis, including PERT and CPM. Introduction to dynamic programming.

4623 Operations Research II

(3-0) 3 hours credit. Prerequisite: STA 3513 or equivalent.

Introduction to probabilistic analysis and models in operations research. Decision analysis, Markov chains, queuing models.

4803 Microprocessor Laboratory

(1-4) 3 hours credit. Prerequisite: SD 3813.

Principles of large-scale integration and very large-scale integration. The organization and systems architecture of state-of-the-art microprocessors. The integration of microprocessors with random-access memory, programmable read-only memory, peripheral controllers and I/O devices.

4823 System Analysis

(3-0) 3 hours credit. Prerequisite: MAT 2213.

Mathematical concepts relevant to the formulation of models for physical systems. Initial value problems. Laplace transforms and the concept of transfer function. Detailed analysis of simple control systems for position and velocity tracking. Stability. The course deals mainly with linear systems.

4843 Real-Time Digital Control

(2-2) 3 hours credit. Prerequisites: CS 2733, MAT 2233 and SD 2813.

Principles of real-time minicomputer operating systems. Programming techniques for on-line interactive data acquisition and control. Study of digital control.

4853 Computer Interfaces

(3-0) 3 hours credit. Prerequisites: CS 2733 and SD 2813.

Basic characteristics and design considerations of printer, tape, and disk controllers, multiplexers and other devices for computer communications and teleprocessing.

4873 Computer Networks

(3-0) 3 hours credit. Prerequisites: SD 2813, CS 2733 and STA 3513.

Discussion of standard network layers including issues of topology, error detection and recovery, congestion control, and hardware interfacing.

COURSE DESCRIPTIONS
COMPUTER SCIENCE/SYSTEMS DESIGN
(CSD)

4901 Seminar in Computer Sciences and Systems Design

(1-0) 1 hour credit. Prerequisite: Upper-division classification.

Scheduled and impromptu presentations on subjects of interest presented by division faculty and visiting lecturers. May be repeated for credit but no more than 3 hours will apply toward the major.

4911-3 Independent Study

1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's Advisor, the Division Director, and Dean of the College in which the course is offered.

Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work. May be repeated for credit, but not more than 6 hours will apply to the bachelor's degree.

4951-3 Special Studies in Computer Science or Systems Design

1-3 hours credit. Prerequisite: Consent of instructor.

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research

(3-0) 3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during the last two semesters; approval by the College Honors Committee.

Supervised research and preparation of an honors thesis. May be repeated one time with approval.