COLLEGE OF SCIENCES AND MATHEMATICS

COLLEGE HONORS

The College of Sciences and Mathematics 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 130.[25] All candidates for the degree must complete:

A. 44 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 3203 Physical Chemistry I
CHE 3212 Physical Chemistry Laboratory

CHE 3223 Physical Chemistry II
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

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 Mathematics, 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, prenursing, 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 is 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, prenursing, 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.

2123 Fundamentals of Organic Chemistry
(3-0) 3 hours credit. Prerequisites: CHE 2003 and 2012. Concurrent enrollment in CHE 2131 is required. May not be applied to a major in chemistry.
A one semester course designed to provide elementary study of the structure of organic compounds and the reactions of organic functional groups.

2131 Fundamentals of Organic Chemistry Laboratory
(0-5) 1 hour credit. Prerequisite: CHE 2012. Concurrent enrollment: CHE 2123. May not be applied to a major in chemistry.
Laboratory study of the physical properties, various methods of separations and syntheses of selected organic compounds.

2203 Organic Chemistry I
(3-0) 3 hours credit. Prerequistes: 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 (crystalization, 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 or consent of instructor.
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.

3203 Physical Chemistry I
(3-0) 3 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: Concurrent enrollment: CHE 3203.
Experimental study of thermodynamics and electrochemistry, spectroscopy, and reaction kinetics.

3223 Physcial Chemistry II
(3-0) 3 hours credit. Prerequisite: CHE 3203.
Chemical kinetics, electrolytes and electrochemistry, elements of quantum mechanics, chemical bonds, spectroscopy, and photo-chemistry. A continuation of CHE 3203.

3232 Instrumental Analysis
(0-6) 2 hours credit. Prerequisites or concurrent enrollment: CHE 3022, 3212, and 3223.
Electrochemical methods; use of modern spectrometric and chromatographic instrumentation in separation, purification, and/or quantitative characterization of chemical systems.

3301 Physical Chemistry Problem Solving I
(1-0) 1 hour credit. Concurrent enrollment: CHE 3203. May not be applied to a major in chemistry.
Development of problem solving skills in physical chemistry.

3311 Physical Chemistry Problem Solving II
(1-0) 1 hour credit. Concurrent enrollment: CHE 3223. May not be applied to a major in chemistry.
A continuation of CHE 3301.

3603 Polymer Science
(3-0) 3 hours credit. Prerequisite: CHE 2203.
Basic principles of polymer science; kinetics and mechanisms of polymerization and copolymerizations; methods of polymerization; molecular weight determinations and characterization of polymers; solution properties, polymer reactions, cross-linking, graft and block copolymerizations; and polymer degradation and stabilization.

3612 Polymer Science Laboratory
(0-6) 2 hours credit. Prerequisite or concurrent enrollment: CHE 3603.
Laboratory projects illustrating and extending the concepts discussed in CHE 3603.

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 3203 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, 3223 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 3203.
A study of the elements and their periodic properties; acid-base theory, crystalline state, coordination chemistry, non-aqueous solvents and other advanced topics.

4272 Advanced Organic Laboratory
(0-6) 2 hours credit. Prerequistes: CHE 3223, 3232, and concurrent enrollment in CHE 4243 or consent of the instructor.
Functional group analysis of organic compounds, structure analysis and proof, multistep synthesis involving functional group modifications, and separation and identification of complex organic mixtures.

4293 Nuclear Chemistry and Physics
(3-0) 3 hours credit. Prerequisites: CHE 3203 and 3223.
A study of nuclear reactions, radiation detection and measurement, and chemical applications.

4301 Nuclear Chemistry and Physics Laboratory
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: CHE 4293 and consent of instructor.
A laboratory study of nuclear reactions, radiation detection and measurement, and chemical applications.

4373 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 measurments 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 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. Prerequisites: CHE 3232, 3252, 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 within any one discipline will apply to a bachelor's degree.

4971 Proseminar
(0-3) 1 hour credit. Prerequisites: CHE 3003 and CHE 3203.
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 studies, 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 136.

All candidates for the degree must complete:

I. 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

II. Requirements within the College of Sciences and Mathematics (excluding Geology): 33 semester hours.

1. *Specific Requirements: 18 semester hours minimum*

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

2. *Additional Requirements: any 15 semester hours minimum with consent of advisor*

CHE	2203	Organic Chemistry I
CHE	2242	Organic Chemistry I Laboratory
CHE	3003	Organic Chemistry II
CHE	3022	Organic Chemistry II Laboratory
CHE	3203	Physical Chemistry I
CHE	3212	Physical Chemistry Laboratory
CHE	3223	Physical Chemistry II
CHE	3301	Physical Chemistry Problem Solving I
CHE	3311	Physical Chemistry Problem Solving II
CHE	4263	Inorganic Chemistry
PHY	2103	Techniques of Solving Problems in Science
PHY	2403	Electronics
PHY	2412	Electronics Laboratory
PHY	3103	Modern Physics I
PHY	3113	Modern Physics II
PHY	3203	Classical Mechanics
PHY	3283	Thermal Physics
PHY	3423	Electricity and Magnetism I
MAT	2213	Calculus III
MAT	2233	Linear Algebra
MAT	3243	Calculus for Applications
MAT	3613	Differential Equations I
MAT	3623	Differential Equations II
STA	1053	Basic Statistics
STA	3513	Probability and Statistics
EGR	2203	Statics

EGR	3213	Mechanics of Solids
ME	3503	Alternative Energy Sources
ME	3663	Fluid Mechanics
CE	4213	Soil Mechanics
CE	4603	Hydraulic Engineering
BIO	1103	Principles of Biology
BIO	1112	Principles of Biology Laboratory
BIO	2063	Invertebrate Biology
BIO	2071	Invertebrate Biology Laboratory
BIO	3003	Introduction to Oceanography

III. Additional Requirements: 3 semester hours

ENG	2413	Technical Writing

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 materials, structure and internal constitution. Nature of minerals and rocks, the hydrosphere, tectonics, 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 materials, structure and internal constitution. Field trips and laboratory study of minerals, rocks, maps and air and satelite 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, CHE 1103. Concurrent enrollment: GEO 2011.
Crystallography, chemistry, physical properties and origin 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 crystallography and optical properties of 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 in immersion liquids and in thin sections.

2063 Paleontology
(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, 1023 and 1031. 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.

3023 Engineering Geology
(3-0) 3 hours credit. Prerequisites: PHY 1904 and 1911 and consent of instructor.
Geologic factors in the construction of large structures and excavations. Physical properties of natural minerals. Case studies.

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.
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.

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. Prerequisities: GEO 3043, 3052, and 3083. Concurrent enrollment: GEO 3131.
Processes of erosion, transportation and deposition that transform the surface of the continents and form bodies of sedimentary rock and their primary structures. Depositional systems and modeling are a significant area of study. Field trips required.

3131 Sedimentary Geology Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 3043 and 3052. Concurrent enrollment: GEO 3123.
Field trips and laboratory studies of sedimentary processes and their products. Hand specimens, sedimentary structures and interpretation of depositional environments are studied.

3143 Economic Geology
(3-0) 3 hours credit. Prerequisites: GEO 2003 and 2011. Concurrent enrollment in GEO 3151.
Ore and industrial mineral genesis. Description and distribution of the major mineral deposits.

3151 Economic Geology Laboratory
(0-2) 1 hour credit. Prerequisites: GEO 2003 and 2011. Concurrent enrollment in GEO 3143.
Laboratory study of ore and industrial minerals. Study of rock and mineral suites from important ore localities.

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, 3111, 3123, and 3131. 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, 3111, 3123, and 3131. Concurrent enrollment: GEO 3182.
Laboratory studies of samples, maps and logs. Preparation of sample logs and subsurface maps.

3373 Geochemistry
(3-0) 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 1003, 1011, PHY 1924 and consent of instructor.
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 air photo bases for geologic mapping. Description, recording, and interpretation of field relationships. Field trips required.

3951-3 Special Interests Topics
1-3 hours credit. Prerequisite: Consent of the instructor.
Special interest geology courses including topics such as geology of Texas, volcanoes and their activity, crystals and gems, geology of Mexico and Central America, and geological investigation of the moon and planets. May be repeated for credit when the topics vary to a maximum of six hours.

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. Prerequisites: GEO 3083, 3103, and 3111 or concurrent enrollment; and concurrent enrollment: GEO 4121.
Interpretation of landforms using geologic techniques. Field trips required.

4121 Geomorphology Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 3083, 3103, and 3111. Concurrent enrollment: GEO 4113.
Interpretation of maps and aerial photographs.

4383 Exploration Geophysics
(3-0) 3 hours credit. Prerequisite: GEO 3383. 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.
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. Prerequisite: 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 3 hours 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 is offered with two options.

I. Physics Option
For students planning graduate study toward a professional career in Physics, Astronomy, 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 136. All candidates for the degree must complete:

A. Division of Earth and Physical Sciences Requirements: 52 semester hours required.

1. *31 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 2103	Techniques of Solving Problems in Science
PHY 3103	Modern Physics I
PHY 3203	Classical Mechanics
PHY 3283	Thermal Physics *or* CHE 3203 Physical Chemistry I
PHY 3423	Electricity and Magnetism I
PHY 3443	Optics
PHY 4263	Introduction to Quantum Mechanics

2. *Additional Requirements: any 21 semester hours (maximum of 3 hours from PHY 4911-3, 4923, 4951-3) with consent of advisor.*

PHY 2403	Electronics
PHY 2412	Electronics Laboratory

PHY	3113	Modern Physics II
PHY	3213	Mechanics of Solids
PHY	3241	Mechanics of Solids Laboratory
PHY	3293	Statistical Mechanics
PHY	3313	Materials Physics
PHY	3321	Materials Physics Laboratory
PHY	3433	Introduction to the Theory of Solid State Electronics
PHY	3452	Optics Laboratory
PHY	3663	Fluid Physics
PHY	4203	Advanced Classical Mechanics
PHY	4223	Acoustics
PHY	4231	Acoustics Laboratory
PHY	4403	Electricity and Magnetism 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 Mathematics (excluding Physics): 39 semester hours required.

1. *Specific Requirements: 24 semester hours.*

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 15 semester hours minimum with consent of advisor.*

MAT	2233	Linear Algebra
MAT	3213	Foundations of Analysis
MAT	3223	Complex Variables
MAT	3233	Modern Algebra
MAT	3243	Calculus for Applications
MAT	3623	Differential Equations II
MAT	3633	Numerical Analysis I
MAT	3643	Numerical Analysis II
CHE	3223	Physical Chemistry II
CHE	4253	Physical Chemistry III

C. Additional Requirements: 3 semester hours

ENG	2413	Technical Writing

II. Applied Physics Option.

The Applied Physics option stresses basic scientific and engineering principles in order to prepare the student in the design, development, and construction of new high technology equipment. For students planning to enter positions in industry upon graduation.

The minimum number of semester hours required for this degree option, including the 42 semester hours of General Education Requirements, is 136. All candidates for the degree must complete:

A. Division of Earth and Physical Science Requirements: *53* semester hours required.

1. *35 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 I
PHY	3203	Classical Mechanics
PHY	3423	Electricity and Magnetism I
PHY	3443	Optics
EGR	3203	Dynamics
ME	3293	Thermodynamics I
EE	2113	Introduction to Electronics
EE	2424	Network Theory I

2. *Additional Requirements: any 18 semester hours (maximum of 3 hours from PHY 4911-3, 4923, 4951-3) with consent of advisor.*

PHY	2403	Electronics
PHY	2412	Electronics Laboratory
PHY	3113	Modern Physics II
PHY	3313	Materials Physics
PHY	3321	Materials Physics Laboratory
PHY	3433	Introduction to the Theory of Solid State Electronics
PHY	3452	Optics Laboratory
PHY	4403	Electricity and Magnetism II
PHY	4911-3	Independent Study
PHY	4951-3	Special Studies in Physics
PHY	4993	Honors Research
EE	3213	Electromagnetic Engineering
EE	3313	Electronic Circuits I
EE	3423	Network Theory II
EE	4313	Electronic Circuits II
ME	3663	Fluid Mechanics
ME	4293	Thermodynamics II

B. Requirements within the College of Sciences and Mathematics (excluding Physics and Engineering): *38* semester hours required.

1. *Specific Requirements: 31 semester hours*

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
CS	1713	Introduction to Computer Science
CS	1711	Introduction to Computer Science Laboratory
SD	2812	Digital Circuits Design I Laboratory
SD	2813	Digital Circuits Design I
SD	3823	Data Acquisition and Distribution

2. *Additional Requirements: any 7 semester hours minimum with consent of advisor.*

MAT	2233	Linear Algebra
MAT	3213	Foundations of Analysis

MAT	3223	Complex Variables
MAT	3233	Modern Algebra
MAT	3243	Calculus for Applications
MAT	3623	Differential Equations II
MAT	3633	Numerical Analysis I
MAT	3643	Numerical Analysis II
CS	1723	Data Structures I
CS	2743	Data Structures II
CS	3233	Discrete Mathematical Structures
CS	4323	Analysis of Algorithms
SD	3812	Digital Circuits Design II Laboratory
SD	3813	Digital Circuits Design II
SD	3843	Small Systems Architecture and Interfacing

C. Additional Requirements: 3 semester hours.

ENG 2413 Technical Writing

COURSE DESCRIPTIONS

PHYSICS
(PHY)

1013 Introduction to Physical Sciences
(3-0) 3 hours credit. Prerequisites: 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 Mathematics 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. For architectural, life sciences, and other interested students.

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.
Continuation of General Physics I. 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.

1703 Energy and the Environment
(3-0) 3 hours credit.
The topics considered, and some of their inter-relations, are: common sources of energy, nuclear, solar and geothermal energy, other possible sources of energy; energy-related materials; and air, water and noise pollution. Use of mathematics is limited.

1904 Technical Physics I
(4-0) 4 hours credit. Prerequisite: MAT 1214. Concurrent enrollment: PHY 1911 is 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.
A continuation of PHY 1904. 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 or CS 1713 and 1711.
Numerical methods and computer applications in solving fundamental problems in science.

2223 Musical Acoustics
(3-0) 3 hours credit. 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. Concurrent enrollment in PHY 2412 is strongly recommended.
AC circuits. The properties and application of diodes, transistors, digital and analog integrated circuits. Practical applications to electronic circuits are stressed.

2412 Electronics Laboratory
(0-6) 2 hours credit. Prerequisite or concurrent enrollment: PHY 2403.
Laboratory to accompany PHY 2403. Construction and testing of electronic circuits and devices. Provides the opportunity to develop electronic skills.

3103 Modern Physics I
(3-0) 3 hours credit. Prerequisite: PHY 1924. Prerequisite or concurrent enrollment: MAT 2213.
Special relativity, Planck's Radiation Law, elements of quantum mechanics, atomic and molecular structures and spectra.

3113 Modern Physics II
(3-0) 3 hours credit. Prerequisite: PHY 3103.
The atomic nucleus, nuclear reactions, and an introduction to elementary particles.

3203 Classical Mechanics
(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.

3213 Mechanics of Solids
(3-0) 3 hours credit. Prerequisite: PHY 3313.
Molecular models of the bulk mechanical properties of crystalline, polymeric and amorphous solids. Polymer theories and thermal effects on mechanical properties.

3241 Mechanics of Solids Laboratory
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 3213.
Laboratory study of Mechanics of Solids to accompany PHY 3213.

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 Materials Physics
(3-0) 3 hours credit. Prerequisite: PHY 3103.
Crystalline structures, the electron and phonon conditions to the thermal, electrical and optical properties of crystalline materials. Superconductivity.

3321 Materials Physics Laboratory
(0-3) 1 hour credit. Prerequisite: PHY 3313.
Determination and methods of evaluating the electrical, thermal, and optical properties of crystalline materials.

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.

3443 Optics
(3-0) 3 hours credit. Prerequisite: PHY 3423. Concurrent enrollment in PHY 3452 recommended.
The reflection, refraction, absorption, polarization, and diffraction of light. Filters and lasers.

3452 Optics Laboratory
(0-6) 2 hours credit. Prerequisite or concurrent enrollment: PHY 3443.
Laboratory application of geometric optics. Laser techniques, scattering and diffraction of light.

3663 Fluid Physics
(3-0) 3 hours credit. Prerequisite: PHY 3203.
Molecular models of the mechanical and thermal properties of fluids. Continuum mechanics and rheology. Diffusion and transport mechanisms and theory.

3953 Electronics for Scientists
(2-3) 3 hours credit. Prerequisite: one year of college Physics.
Application of various basic electronic instruments, devices, and components widely used in biology, chemistry, geology, engineering, and physics. Emphasis on the functional use of these devices.

4203 Advanced Classical Mechanics
(3-0) 3 hours credit. Prerequisite: PHY 3203.
Advanced methods in mechanics, Lagrangian and Hamiltonian formulations.

4223 Acoustics
(3-0) 3 hours credit. Prerequisites: PHY 3203 and MAT 2213. Concurrent enrollment in PHY 4231 is recommended.
Acousitic waves propagation and the interaction of sound with matter.

4231 Acoustics Laboratory
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 4223.
Experimental techniques in acoustics. The study of acoustical properties and acoustic phenomena in materials.

4263 Introduction to Quantum Mechanics
(3-0) 3 hours credit. Prerequisites: PHY 3203, 3253, and 3423, or consent of instructor.
The Schrodinger equation, operators, and perturbation methods. Applications to the harmonic oscillator and the hydrogen atom.

4303 Advanced Materials Physics
(3-0) 3 hours credit. Prerequisite: PHY 3313.
Diamagnetic, paramagnetic, ferromagnetic and dielectric properties of materials. The experimental methods by which these phenomena are studied.

4403 Electricity and Magnetism II
(3-0) 3 hours credit. Prerequisite: PHY 3423.
Theory and applications of electromagnetic fields; Maxwell's equations.

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 3 hours 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 I
(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. Occasional evening viewing sessions are held.

1023 Introduction to Astronomy II
(3-0) 3 hours credit. Prerequisite: AST 1013 or consent of instructor.
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 and challenge of man-machine-community interrelationships within the natural and built environments. General attention is given to the concepts "growth", "process", and "change" in both ecosystem and social contexts for the insights they lend to an understanding of environmental system dynamics and related public policy formulation.

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.

4023 Environment, Energy and Society
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
A review of the sources and application of energy in the United States, its communities and its industries including agriculture, transportation and utilities. National, state, and local governmental energy planning.

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 with 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, ENG 1023 and ENG 1033 and nine additional hours of approved General Education courses. Students who complete the Pre-Engineering requirements with a GPA of 2.5 and who have an overall GPA of 2.5 may apply to become Civil, Electrical or Mechanical Engineering majors.

DEGREE REQUIREMENTS

I. General Education Requirements

All students in the Division of Engineering must satisy the 42 semester hour General Education Requirements established by The University of Texas at San Antonio.

II. General Engineering Requirements

All degree candidates in the Division of Engineering must complete the following 53 semester hours.[1]

A. Pre-Engineering Requirements

CHE	1103	Introductory Chemistry
CHE	2003	Chemical Principles
CS	2073	Programming with Engineering Applications
EGR	1801	Introduction to Engineering
EGR	1802	Engineering Graphics
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

CS	3073	Graphics and Numerical Techniques
EGR	4713	Engineering Economic Analysis
ENG	2413	Technical Writing
MAT	3253	Engineering Analysis I
MAT	3263	Engineering Analysis II
STA	3513	Probability and Statistics
		3 hours Approved Science Elective

BACHELOR OF SCIENCE DEGREE IN CIVIL ENGINEERING

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

[1]CHE 1103, MAT 1214, and PHY 1904 may be used to satisfy the General Education Requirement for nine hours of Sciences and Mathematics.

A. Required Courses (48 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	4113	Transportation Systems
CE	4213	Soil Mechanics
CE	4313	Computer-Aided Design in Civil Engineering
CE	4413	Foundation Engineering
CE	4603	Hydraulic Engineering
CE	4633	Water and Wastewater Treatment
CE	4813	Civil Engineering Design
EGR	2203	Statics
EGR	3203	Dynamics
EGR	3213	Mechanics of Solids
ME	3663	Fluid Mechanics

B. Approved Technical Electives (6 hours)

BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

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

A. Electrical Engineering Core
The following 39 semester hours are required for a Bachelor of Science degree in Electrical Engineering.

EE	2113	Introduction to Electronics
EE	2424	Network Theory I
EE	3113	Electrical Engineering Lab I
EE	3213	Electromagnetic Engineering
EE	3313	Electronic Circuits I
EE	3423	Network Theory II
EE	4113	Electrical Engineering Lab II
EE	4313	Electronic Circuits II
EE	4413	Introduction to Automatic Control
EE	4813	Electrical Engineering Design
SD	2813	Digital Circuits Design I
SD	2812	Digital Circuits Design I Lab
		Engineering Science Elective (3 hours)*

B. Options
Electrical Engineering students may choose either of the following options:

(1) General Electrical Engineering Option (15 hours)

EE	3513	Electromechanical Systems
EE	4613	Communications Systems
SD	3823	Data Acquisition
		Engineering Science Elective (3 hours)*
		Approved Technical Elective (3 hours)

(2) Computer Engineering Option (14 hours)

CS	2733	Computer Organization
SD	3813	Digital Systems Design II

*Choose from EGR 2203, EGR 3203, EGR 3213, ME 3243, ME 3293, or ME 3663.

SD 3812 Digital Systems Design II Lab
SD 3843 Small Systems Architecture and Interfacing
SD 4803 Microprocessor Lab I

BACHELOR OF SCIENCE DEGREE IN MECHANICAL ENGINEERING

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

A. Required Courses (51 hours)

EE	2213	Electric Circuits and Electronics
EE	3502	Electronics and Electromechanical Systems Lab
EE	3513	Electromechanical Systems
EGR	2203	Statics
EGR	3203	Dynamics
EGR	3213	Mechanics of Solids
ME	3243	Materials Engineering
ME	3263	Materials Processing
ME	3293	Thermodynamics I
ME	3313	Measurements and Instrumentation
ME	3663	Fluid Mechanics
ME	4213	Machine Design
ME	4293	Thermodynamics II
ME	4301	Fluid Flow and Thermal Science Lab
ME	4313	Heat Transfer
ME	4813	Mechanical Engineering Design
SD	3823	Data Acquisition
SD	3833	Real-Time Digital Control

B. Approved Technical Electives (3 hours)

COURSE DESCRIPTIONS

ENGINEERING (EGR)

1101 Introduction to Engineering
(1-0) 1 hour credit.
Engineering as a career. Approaches to engineering problem solving and design through the use of engineering principles.

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.

1802 Engineering Graphics
(1-3) 2 hours credit.
Freehand and instrument drawing; shape and size description; pictorial methods; freehand lettering; charts and graphs. Credit may not be obtained for both AS 1802 and EGR 1802.

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.

3203 Dynamics
(3-0) 3 hours credit. Prerequisite: PHY 1924. Prerequisite or concurrent enrollment: 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. Prerequisites: 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 or registration for 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.

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. Prerequisites: STA 3513 and credit or registration for EGR 4713.
Planning, design, construction, operation and maintenance of transportation systems; concepts of various modes of transportation.

4213 Soil Mechanics
(2-3) 3 hours credit. Prerequisite: EGR 3213.
Engineering properties of soils, settlement of embankments and foundations of structures, bearing capacity of foundations, and laboratory measurements.

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
(3-0) 3 hours credit. Prerequisite: CE 3113.
Energy methods; deflection of structures. Structural analysis of forces and deflections using energy methods and computer methods.

4603 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.

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, quantitites, 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.

4813 Civil Engineering Design
(1-6) 3 hours credit. Prerequisites: CE 3213, CE 3233, CE 4313, CE 4603, and credit or registration for CE 4413.
Analysis and design of systems involving civil engineering principles.

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. 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 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 will apply to a bachelor's degree.

COURSE DESCRIPTIONS
ELECTRICAL ENGINEERING
(EE)

2113 Introduction to Electronics
(3-0) 3 hours credit. Prerequisites: CHE 2003 and credit or registration for EE 2424.
Electrical properties of materials, conduction processes with emphasis on semiconductors, diode circuits, transistor models, and elementary amplifiers.

2213 Electric Circuits and Electronics
(3-0) 3 hours credit. Prerequisites: PHY 1924, PHY 1931, and credit or registration for MAT 3253.
Electric, magnetic, and electronic circuits; transients, transforms, phasors; solid state devices; analog and digital circuits.

2424 Network Theory I
(3-3) 4 hours credit. Prerequistes: PHY 1924, PHY 1931, and credit or registration for MAT 3253.
Basic network principles; steady state response to DC and AC signals; simple transient response; nodal and loop analysis. Credit may not be obtained for both PHY 2424 and EE 2424.

3113 Electrical Engineering Laboratory I
(1-4) 3 hours credit. Prerequisites: CS 2073 and credit or registration for 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: EE 2424 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: EE 2113 and credit or registration for EE 3423.
Electronic devices in analog and digital circuits, power circuits, frequency response, tuned cirucits, modulation and detection systems.

3423 Network Theory II
(3-0) 3 hours credit. Prerequisites: EE 2424 and MAT 3253, and credit or registration for MAT 3263.
Transient response of networks by Fourier and Laplace transform methods, frequency domain techniques and time domain techniques.

3502 Electronics and Electromechanical Systems Laboratory
(0-6) 2 hours credit. Prerequisites: EE 2213 and credit or registration for EE 3513.
Basic experiments in analog and digital circuits, electronic instrumentation, and electromechanical devices.

3513 Electromechanical Systems
(3-0) 3 hours credit. Prerequisites: EE 2213, or EE 3213 and EE 3423.
Principles of electromechanical energy conversion; magnetic circuits, polyphase circuits; dynamic analysis of energy-transfer devices.

4113 Electrical Engineering Lab II
(1-4) 3 hours credit. Prerequisites: EE 3113 and credit or registration for EE 3213 and EE 4313.
Experimental solution of engineering problems including design, optimization, evaluation, and simulation; measurements in pulsed, UHF, and modulation systems.

4313 Electronic Circuits II
(3-0) 3 hours credit. Prerequisites: SD 2813 and EE 3313.
Feedback principles, operational amplifier circuits, oscillators, pulse and switching circuits.

4413 Introduction to Automatic Control
(3-0) 3 hours credit. Prerequisite: Credit or registration for EE 4313.
Analysis of linear automatic control systems in frequency and time domains; stability analysis; state variable analysis; root laws; frequency plots; sensitivitiy, lead and lag compensation.

4613 Communications Systems
(3-0) 3 hours credit. Prerequisites: EE 3423 and MAT 3263.
Modulation and detection, theory and circuit implementations, baseband and RF spectra; analog and digital transmission; information theory and coding techniques.

4623 Digital Filtering and Signal Processing
(3-0) 3 hours credit. Prerequisites: EE 3423 and MAT 3263 or consent of instructor.
Discrete signals, discrete Fourier transform, z-transform, recursive and non-recursive filters, and power spectrum estimation.

4633 Optical Communications
(3-0) 3 hours credit. Prerequisites: EE 2113 or PHY 3113, and MAT 3263.
Fiber and integrated optics, Fourier optics, optical signal processing, and principles of visible and IR sources and detectors.

4813 Electrical Engineering Design
(1-6) 3 hours credit. Prerequisites: EE 4113, EE 4313, and credit or registration for EE 4413.
Analysis and design of systems involving electrical engineering principles.

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 6 hours 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 will apply to a bachelor's degree.

COURSE DESCRIPTIONS
MECHANICAL ENGINEERING
(ME)

3243 Materials Engineering
(2-3) 3 hours credit. Prerequisites: CHE 1103, MAT 2213, and credit or registration for 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 3203.
Casting, joining, forming and machining; effects of processing on materials.

3293 Thermodynamics I
(3-0) 3 hours credit. Prerequisites: CHE 2003, PHY 1924, and MAT 2213.
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, MAT 3253 and STA 3513.
Fundamentals of measurement systems; standards, treatment of data; transducers, signal conditioning; strain, force, acceleration, pressure, temperature, fluid flow.

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.

3663 Fluid Mechanics
(3-0) 3 hours credit. Prerequisites: EGR 2203 and MAT 2213.
Fluid properties; fluid statics, concepts and equations of fluid flow; similitude; viscous effects; compressible fluid flow.

4213 Machine Design
(3-0) 3 hours credit. Prerequisites: EGR 3213, MAT 3263, ME 3263, and STA 3513.
The theoretical and practical aspects of the design of machine elements and simple systems; stress analysis and the theory of fatigue.

4293 Thermodynamics II
(3-0) 3 hours credit. Prerequisites: ME 3293, and credit or registration for ME 3663.
Nonreactive and reactive mixtures, vapor and gas power cycles, refrigeration, and compressible flow.

4301 Fluid Flow and Thermal Science Laboratory
(0-3) 1 hour credit. Prerequisites: ME 3313 and credit or registration for ME 4313.
An experimental laboratory concerned with the analysis of the fundamental principles of fluid statics, fluid flow, and heat transfer.

4313 Heat Transfer and Rate Processes
(3-0) 3 hours credit. Prerequisites: MAT 3253, ME 3293 and credit or registration for ME 3663.
Generalized potential distribution and gradients; transient and steady heat conduction; forced and free convection; radiation, energy, and momentum transfers.

4813 Mechanical Engineering Design
(1-6) 3 hours credit. Prerequisites: ME 3313, ME 4213, and ME 4313.
Analysis and design of systems involving mechanical, thermal, hydraulic, and electrical engineering principles.

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. 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 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 will apply to a bachelor's degree.

DIVISION OF LIFE SCIENCES

The Division offers a Bachelor of Science 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.[21]

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. The preclinical curriculum includes general education requirements and basic science lecture and laboratory 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 the medical technology national board examinations of the American Society of Clinical Pathologists.

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.[22] All candidates for the degree must complete:

A. 48 semester hours in the *major*, 28 of which must be at the upper-division level.

   1. 30 semester hours in the Biology Core Curriculum are required:

[21]Specific 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.

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

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 Health Science Center. Participation in medical technology courses does not guarantee acceptance into the Medical Technology 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. This application should be submitted at the completion of the student's sophomore year by May 15. Admission to the Joint Degree Program and successful continuation in the program provide the student with a clinical position at the Health Science Center for continuation of medical technology training.

186 / UTSA/UTHSC Joint Bachelor of Science Degree in Medical Technology

Upon successful completion of this joint degree program the student is eligible to take the national examination for registration with the Board of Registry of the American Society of Clinical Pathologists. All students are encouraged to be counseled 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 142.

All candidates for the degree must complete:

A. 79 semester hours in the major.

1. 22 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,	4751	Immunology and Laboratory

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. *46 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	Advanced Clinical Microbiology
*MEDT	40383	Advanced Clinical Chemistry
*MEDT	40353	Advanced Clinical Hematology
*MEDT	40365	Advanced Clinical Immunohematology and Serology
*MEDT	40671	Clinical Field Work Experience I
*MEDT	40672	Clinical Field Work Experience II
*MEDT	40192	Education Techniques for the Medical Technologist
*MEDT	40193	Management Techniques for Medical Technologists

B. 21 semester hours of support work.

1. 10 semester hours are required in Chemistry:

CHE	2003	Chemcial 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

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

3. 3 semester hours (in addition to the 3 semester hours required under the General Education Requirements) are required in Mathematics.

   STA 1053 Basic Statistics

UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE IN OCCUPATIONAL THERAPY

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

All students must be accepted for admission to The University of Texas at San Antonio prior to application for the professional phase of the Occupational Therapy Program. This admission, however, does not assure admission into the Occupational Therapy Program.

All students are encouraged to be counseled by either the Occupational Therapy Program Director or a member of the Occupational Therapy faculty to ensure enrollment in appropriate course work. Appointments may be scheduled by calling (512) 691-7555.

Each student must make application for admission to the professional phase of the Occupational Therapy Program by February 1st of the year they wish to be admitted. The application process can be initiated by writing to: Admissions Committee, Occupational Therapy Program, The University of Texas Health Science Center at San Antonio, San Antonio, Texas, 78284. Students who apply must be at least in the first semester of their Sophomore year. It is the responsibility of the applicant to submit official transcripts to the UTSA Office of Admissions prior to February 1st. It is also the applicant's responsibility to have three letters of reference submitted to the Occupational Therapy Admissions Committee with their application form.

Each student is expected to complete all General Education Requirements for graduation from UTSA, as well as program prerequisites for Occupational Therapy by June of the year of admission to the professional phase of the Occupational Therapy Program.

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 135.

All candidates for the degree must complete:

A. 86 semester hours in the *major*, 80 of which must be at the upper-division level.
   1. 4 semester hours are required in the biological sciences:

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

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

      **AHS 1871 Allied Health Sciences
      AHS 1891 Survey of Physical Medicine and Rehabilitation

**UTSA Students only.

3. 80 semester hours are required at the University of Texas Health Science Center at San Antonio:

*OCCT 30200	Principles of Practice
*OCCT 30321	Occupational Therapy Media I
*OCCT 30322	Occupational Therapy Media II
*OCCT 30475	Dynamics of Motion
*OCCT 30331	Occupational Therapy Theory I
*OCCT 30391	Occupational Therapy Skills Laboratory I
*OCCT 40392	Occupational Therapy Skills Laboratory II
*OCCT 40393	Occupational Therapy Skills Laboratory III
*OCCT 40223	Occupational Therapy Media III
*OCCT 40332	Occupational Therapy Theory II
*OCCT 40150	Seminar in Rehabilitation
*OCCT 40333	Occupational Therapy Theory III
*OCCT 40382	Allied Health Management and Consultation
*OCCT 40394	Special Project
*PATH 30311	Introductory Pathology
*ANAT 30816	Human Anatomy
INDT 30212	Intro to Computers for Health Professions
*PHYL 30013	Human Physiology
*INDT 30471	Human Neurosciences
*MEDI 30311	Clinical Medicine I
*MEDI 40212	Clinical Medicine II
*MEDI 40313	Clinical Medicine III
*OCCT 30271	Fieldwork Level I (Physical Dysfunction)
*OCCT 30272	Fieldwork Level I (Psychosocial Dysfunction)
*OCCT 30273	Fieldwork Level I (Pediatrics)
*OCCT 40874	Fieldwork Level IIA

B. 7 semester hours of *support work.*

1. 4 semester hours are required in Chemistry:

CHE	1003, 1111	General Chemistry for Allied Health Sciences and Laboratory
		or
CHE	1103, 1122	Introductory Chemistry and Laboratory Workshop

2. 3 semester hours are required in Psychology:

PSY	2513	Abnormal Psychology

UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY

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

All students must be accepted for admission to The University of Texas at San Antonio prior to application for the professional phase of the Physical Therapy Program. This admission, however, does not assure admission into the Physical Therapy Program.

Incoming or first semester freshmen students may apply for a guaranteed position within the professional phase of the Physical Therapy Program if they have met the specified requirements during their high school preparation. For information on early

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

admission contact: Early Admission Program, Physical Therapy Program, The University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284. All other applicants are expected to make application during the fall semester of their sophomore year. For information on the application process contact: Admission Committee, Physical Therapy Program, The University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284.

All Physical Therapy majors are expected to seek academic counseling from the Physical Therapy faculty. Appointments can be made in the Division of Life Sciences Office, 4.02.32SB.

All qualified students are expected to have an interview with Physical Therapy Faculty after the close of application on December 15th and prior to announcement of student selections on April 1st. 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 150.

All candidates for the degree must complete:

A. 95 semester hours in the major, 80 of which must be at the upper-division level.

1. 12 semester hours are required in the biological sciences:

BIO	1103,	1112	Principles of Biology and Laboratory
BIO	2123,	2131	Comparative Anatomy of Vertebrates and Laboratory
			or
AHS	2083,	2091	Human Biology: Anatomy and Laboratory
BIO	3413		General Physiology

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

**AHS	1871	Allied Health Sciences
**AHS	1891	Survey of Physical Medicine and Rehabilitation

3. *81 semester hours are required at The University of Texas Health Science Center at San Antonio:

*PATH	30311	Introductory Pathology
*ANAT	30816	Human Anatomy
*PHYL	30612	Mammalian Physiology

Courses in the Physical Therapy Curriculum

Prefix	Number	Title
*ANAT	30816	Human Anatomy
*INDT	30471	Human Neurosciences
*MEDI	30311	Clinical Medicine I
*MEDI	40313	Clinical Medicine III
*PATH	30311	Pathology
*PHYL	30613	Mammalian Physiology
*PHYT	30101	Directed Clinical Experience I
*PHYT	30102	Clinical Observation I
*PHYT	30103	Clinical Observation II
*PHYT	30122	Therapeutic Exercise II

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

*PHYT	30130	Physical Therapy Precedures I
*PHYT	30210	Therapeutic Concepts I
*PHYT	30211	Fundamentals of Physical Therapy
*PHYT	30221	Therapeutic Exercise I
*PHYT	30231	Physical Therapy Procedures II
*PHYT	30440	Human Development
*PHYT	30475	Dynamics of Human Motion
*PHYT	40104	Simulated Clinic
*PHYT	40105	Directed Clinical Exp. II
*PHYT	40123	Therapeutic Exercise III
*PHYT	40124	Therapeutic Exercise IV
*PHYT	40150	Seminar in Rehabilitation
*PHYT	40151	Senior Seminar
*PHYT	40311	Therapeutic Concepts II
*PHYT	40325	Therapeutic Exercise V
*PHYT	40382	Supervision & Management
*PHYT	40394	Introduction to Research Methodology
*PHYT	40471	Field Work I
*PHYT	41072	Field Work II

B. 13 semester hours of support work.

1. 5 semester hours are required in Chemistry:

CHE	2003	Chemical Principles
CHE	2012	Inorganic Qualitative and Quantitative Analysis

2. 8 semester hours are required in Physics:

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

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.

1871 Allied Health Sciences
(1-0) 1 hour credit.
Nature of the various allied health science programs and their interrelation. On-site hospital visits to the various programs. This course is taught on a credit/no credit basis only. Students completing this course will receive a grade of CR or NC.

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 material to body systems, and medical terminology and medical laboratory calculations.

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

1891 Survey of Physical Medicine and Rehabilitation
(1-0) 1 hour credit. Prerequisite: AHS 1871.
The role of each therapeutic discipline working within the process of rehabilitation. Topics include medical terminology, ethics, and effects of illness on the patient.

2011 Introduction to Physical Therapy
(1-0) 1 hour credit. Prerequisites: AHS 1891 and the consent of the Program Director.
Fundamental concepts of basic patient care and management utilization in Physical Therapy.

2021 Physical Therapy History
(1-0) 1 hour credit. Prerequisites: AHS 2011 and the consent of the Program Director.
History and philosophy of the profession including presentation on the various aspects of Physical Therapy.

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 1113 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.

3471 Human Physiology Laboratory
(0-3) 1 hour credit.
Concurrent enrollment: AHS 3463.

3812 Clinical Seminar
(2-0) 2 hours credit.
Analysis of treatment modalities related to clinical treatment.

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. For student needing specialized work. May be repeated for credit, but not more than 6 hours will apply to the 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 major in Biology.
Human reproductive anatomy and physiology, fertility control, reproductive disease, and parameters influencing fertility patterns.

2063 Invertebrate Biology
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 2071.
A course offering the opportunity for a comprehensive study of the invertebrate animals with emphasis on their taxonomy, morphology, ecology, and evolution.

2071 Invertebrate Biology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 2063.

2123 Comparative Anatomy of Vertebrates
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 2131.
A detailed study of anatomical differences and similarities of vertebrates with reference to evolutionary changes.

2131 Comparative Anatomy of Vertebrates Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 2123.

2313 Genetics
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 1103, 2003, and MAT 1063 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.

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 3413 and 3422. Concurrent enrollment: BIO 3152.
Sequential analysis of development in vertebrates and the factors which effect 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. Prerequisites: BIO 1103 or consent of instructor.
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 BIO 1112. 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 1823; 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 3513 and 3522. Concurrent enrollment: BIO 3541.
The course offers the opportunity to study the interactions of ionizing, ultraviolet, and visible radiations with matter; biological effects; and cellular repair of radiation damage.

3541 Radiation Biology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 3533.

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. Concurrent enrollment: BIO 3741.
A study of fermentations of industrial importance, food processing, and quality control.

3741 Industrial Microbiology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 3733.

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.
An examination of the ethical, philosophical and social implications of studies in those areas of the life sciences which affect public policy or action, e.g., incentives to slow population growth; psychology of consciousness and definitions of life and death.

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 communites.

4233 Field Biology
(3-0) 3 hours credit. Prerequisites: BIO 1013, or BIO 1103, 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. Concurrent enrollment: BIO 4361.
A phylogenetic study of physiologic adaptation in animals.

4361 Comparative Animal Physiology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 4353.
A laboratory course illustrating the principles presented in BIO 4353.

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. Prerequisites: BIO 3713 and 3722. Concurrent enrollment: BIO 4731.
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. Concurrent enrollment: BIO 4751.
A study of the properties of antigens and antibodies, current concepts of humoral and cell-mediated immunity and the cells involved.

4751 Immunology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 4743.

4763 Parasitology
(3-0) 3 hours credit. Prerequistes: BIO 3713 and 3722. Concurrent enrollment: BIO 4771.
A study of the animal parasites of humans and related hosts with emphasis on their epidemiology, life cycles, pathology and control.

4771 Parasitology Laboratory
(0-3) 1 hour 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. 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 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 within any one discipline will apply to a bachelor's degree.

4963 Seminar in Biology
(1-0) 1 hour 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 candidates for the Bachelor of Science degree in Computer Science and Systems Design, regardless of concentration, must complete the following 37 semester hours of required courses (which includes the 3 hours of General Education Requirements in Mathematics, Computer Science and Systems Design):

The student who is not prepared to begin MAT 1214 must take MAT 1093, Precalculus.

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
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
SD	2812	Digital Circuits Design I Laboratory
SD	2813	Digital Circuits Design I

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
   A. Required courses: 15 semester hours.

CS	3233	Discrete Mathematical Structures
CS	3723	Introduction to Programming Languages
CS	3733	Operating Systems
CS	3773	Programming Methodology
CS	4753	Computer Architecture

   B. Any 12 additional semester hours of approved elective courses in the Division of Mathematics, Computer Science, and Systems Design with a course number of 2000 or above.

C. Electives, 23 semester hours.

2. Concentration in Systems Design

A. Required courses: 14 semester hours.

SD	3812	Digital Circuits Design II Laboratory
SD	3813	Digital Circuits Design II
SD	3833	Real Time Digital Control
SD	3843	Small Systems Architecture and Interfacing
SD	4803	Microprocessor Laboratory I

B. An additional 9 semester hours chosen from the following courses:

CS	3723	Programming Languages
CS	3743	Data Base Management
CS	3773	Programming Methodology
CSD	4911-3	Independent Study
CSD	4953	Special Problems
SD	3853	Instrumentation Circuits Design
SD	3863	Real Time Operating Systems for Minicomputers
SD	4813	Microprocessor Laboratory II
SD	4823	Systems Analysis
SD	4833	Optimal Control
SD	4853	Computer Interfaces
SD	4873	Computer Networks
MAT	3613	Differential Equations I
MAT	3633	Numerical Analysis I
MAT	3643	Numerical Analysis II

C. Any 3 upper-division hours of approved elective courses in the Division of Mathematics, Computer Science, and Systems Design.

D. Electives, 24 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 126. 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 29 semester hours of required courses (which includes the 3 hours of General Education Requirements in Mathematics, Computer Science and Systems Design):

The student who is not prepared to begin MAT 1214 must take MAT 1093, Precalculus.

MAT	1214	Calculus I
MAT	1223	Calculus II
MAT	2213	Calculus III

[29]Thirty-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.

MAT	2233	Linear Algebra
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

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: 24 semester hours.

MAT	2243	Foundation of Mathematics
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. Any 6 additional hours of approved courses in the division with course numbers of 3000 or above.

   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	3313	Introduction to Sample Survey Theory and Methods
STA	3433	Applied Non-Parametric Statistics
STA	4713	Applied Regression Analysis
STA	4723	Design and Analysis of Experiments

   B. Any 9 additional hours of approve courses in the division with course numbers of 2000 or above with at least 6 hours with course numbers of 3000 or above.

   C. Electives, 28 semester hours.

3. Concentration in Mathematics Education.
   A. Required Courses: 12 semester hours.

COM	1043	Introduction to Communication
MAT	3233	Modern Algebra
MAT	4263	Geometry

   Any 3 additional hours taken in the Division of Mathematics, Computer Science and Systems Design with course number of 3000 or above.

   B. 24 hours in a second teaching field.

   NOTE: If the second teaching field is chosen to be Computer Science, the student will have completed 7 of these 24 hours from the Mathematics core. This in turn would allow 7 hours of free elective.

   C. Professional Education, 4 semester hours.

EDU	2001	Introduction to the School Environment

EDP 3013 Growth, Development and Learning Theories

D. Education Professional Semester and Student Teaching, 15 semester hours.

EDP 4013 Measurement, Diagnosis and Prescription in Educational Settings
EDU 4031 Media Technology
EDU 4056 Student Teaching: Secondary
EDU 4072 Individualized Clinical Experiences
EDU 4093 Teaching in the Secondary School

NOTE: These courses are taken concurrently in the first or second semester of the senior year. Math majors may student teach only in the Spring semester.

E. Elective, 3 semester hours.

COURSE DESCRIPTIONS
COMPUTER SCIENCE
(CS)

1043 Computer Programming for Business Applications
(3-0) 3 hours credit. Prerequisite: STA 1064.
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.

1073 Introductory Computer Programming for Scientific Applications
(3-0) 3 hours credit. Prerequisite: MAT 1013 or MAT 1183.
Introductory programming. Sorting and ranking; plotting; numerical taxonomy. Solution of non-linear equations; linear regression. Solution of linear systems. Students majoring in the Division of Mathematics, Computer Science, and Systems Design receiving credit for CS 1073 may not also receive credit for CS 1063 nor for CS 1043.

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. Credit cannot be earned for both CS 1711 and CS 1714.

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. Credit cannot be earned for both CS 1713 and CS 1714.

1723 Data Structures I
(3-0) 3 hours credit. Prerequisites: CS 1711 and 1713, or 1714, and MAT 1214.
Common data structures, operations and alternate methods of data representation. Pointers, linear structures (lists, queues, stacks, strings). arrays and array address calculations, and trees.

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 to a major in Mathematics, Computer Science, and Systems Design.

2073 Computer Programming With Engineering Applications
(3-0) 3 hours credit. Prerequisite: 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 to a major in Mathematics, Computer Science, and Systems Design.

2083 Microcomputer Programming For Teachers
(3-0) 3 hours credit. Prerequisite EDU 2001.
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.

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 to a major in Mathematics, Computer Science, and Systems Design.

2733 Introduction to Computer Organization
(3-0) 3 hours credit. Prerequisite: CS 1723 or 2073.
An examination of the basic architecture of a conventional computer and an introduction to the assembly language of such a computer. Several assembly language programs will be required of each student.

2743 Data Structures II
(3-0) 3 hours credit. Prerequisite: CS 1723.
An introduction to data file management. Storage device characteristics, files (access, file types), searching and sorting (hash coding, tables, directories).

3073 Computer Graphics and Numerical Techniques
(3-0) 3 hours credit. Prerequisites: CS 2073 or CS 1723 and enrollment in MAT 3253 or MAT 3613.
Computer graphics, numerical analysis, and advanced programming techniques with applications to engineering problems.

3133 Computers and Society
(3-0) 3 hours credit. Prerequisite: Any one of the following courses: CS 1043, 1063, 1073, 1133, or 1713, 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 and MAT 2213.
Survey and development of theoretical tools suitable for describing algorithmic applications. Propositional logic, predicate calculus, induction, proofs, finite state automata, and boolean algebra.

3321 Topics In Problem Solving Using High Level Languages
(1-0) 1 hour credit. Prerequisite: CS 1723.
Problem solving techniques using a high-level language. Languages will vary and include COBOL, FORTRAN, BASIC, PL/I, LISP, and SNOBOL. 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: MAT 2213, CS 2733 and 2743.
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 and 2743.
An introduction to the functions and major techniques of a modern multi-programming operation 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: MAT 2213, CS 2743.
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: MAT 2213, CS 2743.
Discussion of modular (structured) programming methods, programming style and program verification techniques.

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 Computer Science and Systems Design or Mathematics.

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 between 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 3773 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.

4713 Compiler-Writing Laboratory
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: 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.

1023 Calculus for the Social Sciences
(3-0) 3 hours credit. Prerequisite: MAT 1013 or 1183 or the equivalent.
A general introduction to differential and integral calculus for non-science majors: graphing and analyzing polynomial, logarithmic and exponential functions.

1033 Algebra with Calculus for Business
(3-0) 3 hours credit. Prerequisite: MAT 1013 or 1183 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. Prerequisite: MAT 1013 or the equivalent.
Algebraic expressions; equations, relations, functions; exponentials and logarithmic 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 or the equivalent.
Polynomial and rational functions, exponential functions, logarithmic functions, trigonometric functions. Formerly MAT 1092. Credit cannot be earned for both 1092 and 1093.

1103 Consumer Mathematics
(3-0) 3 hours credit.
A course designed to offer the student the opportunity to gain the necessary mathematical tools for coping with modern technological society. Linear equations and inequalities, ratios, proportion and variation, mathematics of finance.

1113 Mathematics for Elementary Teachers I
(3-0) 3 hours credit. Open only to declared majors in Elementary Education.
Areas of study from arithmetic and geometry; number systems.

1123 Mathematics for Elementary Teachers II
(3-0) 3 hours credit. Prerequisite: MAT 1113 or equivalent. Open only to declared majors in Elementary Education.
Areas of study include logic and algebra.

1214 Calculus I
(4-0) 4 hours credit. Prerequisite: MAT 1093 or the equivalent.
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.

1993 Topics in Mathematics
(3-0) 3 hours credit. Consent of instructor.
Introductory study of a topic or topics in mathematics. May be repeated for credit when topics vary, but no more than 3 hours will apply to a bachelor's degree.

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 1123. Open only to declared Elementary Education majors.
Areas of study from college algebra including linear and quadratic equations and inequalities, systems of equations, graphical methods.

3123 Geometry for Elementary Teachers
(3-0) 3 hours credit. Prerequisite: MAT 1123. Open only to declared Elementary Education majors.
A survey course encompassing topics from plane geometry, including an axiomatic development of proofs, coordinate geometry, non-euclidean geometry, 3-dimensional geometry and topology.

3213 Foundations of Analysis
(3-0) 3 hours credit. Prerequisite: MAT 2213.
An opportunity for rigorous development of the foundations of real analysis; basic point set topology in R^1 and 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 2213.
Line integrals, Green's theorem, Stokes' theorem, Fourier series, Laplace transforms.

3253 Engineering Analysis I
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Linear Algebra, differential equations, Fourier analysis, and boundary value problems.

3263 Engineering Analysis II
(3-0) 3 hours credit. Prerequisite: MAT 3253.
Vector calculus, complex variables, and Laplace transforms.

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. Prerequsite: 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.

3643 Numerical Analysis II
(3-0) 3 hours credit. Prerequisite: MAT 3633.
Numerical solution of ordinary and partial differential equations.

3923 Finance Mathematics
(3-0) 3 hours credit. Prerequsite: 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. Open only to declared Elementary Education majors.
Selected mathematical subjects of an advanced nature relevant to the modern elementary mathematics curriculum.

4123 History of Mathematics for Teachers
(3-0) 3 hours credit. Prerequisite: MAT 2213 or both MAT 3113 and MAT 3123 or consent of instructor. Open only to preservice and inservice teachers.
Selected subjects in mathematics developed through historical perspectives and biographies.

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; integraton.

4233 Modern Abstract Algebra I
(3-0) 3 hours credit. Prerequisite: MAT 2243 and MAT 3233.
An in-depth study of groups and rings.

4243 Modern Abstract Algebra II
(3-0) 3 hours credit. Prerequisite: MAT 4233.
Topics in field theory and vector spaces.

4253 Number Theory
(3-0) 3 hours credit. Prerequisite: MAT 2213.
The theory of primes, congruences and related subjects.

4263 Geometry
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Projective, affine and non-Euclidean geometry.

4273 Topology
(3-0) 3 hours credit. Prerequisite: 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. 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 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 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 1183.
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.

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.
Principles and methodology of estimation and testing hypotheses. Chi-square tests. Linear regression. Nonparametric tests. Analysis of variance.

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.

4733 Statistical Design and Model Building
(3-0) 3 hours credit. Prerequisite: STA 1993 and 3523.
Elements of model building. Fitting linear models to data. Factorial designs. Response surface methodology.

4903 Reliability In Engineering Design
(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 engineering.

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, concentrating on TTL technology. Credit cannot be earned for both SD 2812 and SD 2815.

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. Credit cannot be earned for both SD 2813 and SD 2815.

3812 Digital Circuits Design II Laboratory
(0-4) 2 hours credit. Prerequisite: Concurrent enrollment in SD 2833.
Laboratory to accompany SD 2833. Credit cannot be earned for both SD 2832 and SD 2835.

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. Credit cannot be earned for both SD 2833 and SD 2835.

3823 Data Acquisition and Distribution
(2-2) 3 hours credit. Prerequisites: CS 2073 or both CS 1711 and 1713.
Fundamentals of assembly language for a minicomputer. Programming techniques used to interface a minicomputer to scientifc laboratory instrumentation. Analog and digital data formats and characteristics. Credit may not be earned for both SD 3823 and SD 3843.

3833 Real-Time Digital Control
(2-2) 3 hours credit. Prerequisite: SD 3823.
Principles of real-time minicomputer operating systems. Programming techniques for on-line interactive data acquisition and control. Efficient and reliable system designs.

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, 3823 and PHY 1923.
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.

3863 Real-Time Operating Systems for Minicomputers
(3-0) 3 hours credit. Prerequisite: SD 3823 or CS 3733.
A study in the design of real-time operating systems for minicomputers. Memory management. Task scheduling in a multitask environment, input/output scheduling, and spooling.

4613 Operations Research I
(3-0) 3 hours credit. Prerequisites: 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.

4633 Simulation
(3-0) 3 hours credit. Prerequisite or concurrent enrollment: CS 1723.
Construction and use of simulation models on a digital computer. Monte Carlo techniques and associated statistical methods.

4803 Microprocessor Laboratory I
(1-4) 3 hours credit. Prerequisite: SD 3843.
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 1/0 devices. Assemblers, compilers and operating systems for microprocessors.

4813 Microprocessor Laboratory II
(1-4) 3 hours credit. Prerequisite: SD 4803.
Students execute projects dealing with the design and implementation of microprocessor software for selected applications in the area of systems design.

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.

4833 Optimal Control
(3-0) 3 hours credit. Prerequisite: SD 4823.
Stability and Liapunov's method. Formulation of state equations for continuous and discrete systems. Formulation of the optimal control problem. Pontryagin's maximum principle. Dynamic programming; adaptive control systems.

4853 Computer Interfaces
(3-0) 3 hours credit. Prerequisite: SD 4803.
Basic characteristics and design considerations of printer, tape, disk controllers, multiplexers and other devices for computer communications and teleprocessing.

4873 Computer Networks
(3-0) 3 hours credit. Prerequisites: SD 2813, SD 2812, CS 2733.
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, 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 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 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 with approval.