COLLEGE OF SCIENCES & ENGINEERING

COLLEGE OF SCIENCES AND ENGINEERING

COLLEGE HONORS

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

Selection of students for admission to the College Honors Program is based on the student's academic performance and 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 3.0 overall at UTSA and a minimum grade-point average of 3.0 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 basic science 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. The degree in Multidisciplinary Science gives students broad training in the sciences and is suitable as a preparation to teach science at the secondary school level. The Division also offers minors in Chemistry, Physical Chemistry, Geology, and Physics.

BACHELOR OF SCIENCE DEGREE IN MULTIDISCIPLINARY SCIENCE

This degree is primarily for students preparing to teach science at the secondary school level.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 138.

A. 45 or 47 semester hours of required science courses:

AST	1013, 1031	Introduction to Astronomy and Laboratory
BIO	1203, 1212	Biology I and Laboratory Investigations in Biology

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Students seeking teacher certification should contact the Office of Teacher Advising, Certification, and Placement early in their studies for information about certificate requirements and admission procedures. Undergraduates seeking elementary teacher certification must complete the Interdisciplinary Studies degree.

BIO	2123	Comparative Anatomy of Vertebrates
CHE	1103, 1122	General Chemistry and Laboratory Workshop
CHE	1303	Chemical Principles
CHE	1312	Inorganic Qualitative and Quantitative Analysis
GEO	1103, 1111	Introduction to Earth Systems and Laboratory
GEO	1123, 1131	Earth History and Laboratory
GEO	4113, 4121	Geomorphology and Laboratory
GRG	3713	Weather and Climate

Either

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

or

PHY	1904, 1911	Technical Physics I and Laboratory
PHY	1924, 1931	Technical Physics II and Laboratory

B. 29 semester hours of approved electives in biology, chemistry, physics, geology, and/or mathematics. 15 of these must be at the upper-division level.

C. 6 semester credit hours in computer science and mathematics:

CS	1073	Introductory Computer Programming for Scientific Applications

or

CS	2083	Microcomputer Applications
MAT	1093	Precalculus (or above)

D. 24 semester hours of electives, as set forth below:

1. For students seeking the degree only (without teacher certification), these elective hours must include a sufficient number of upper-division hours to meet UTSA's minimum of 39 upper-division hours.

2. For students seeking the degree with teacher certification, these elective hours must include:

   IDS 3003 Science and Humanity
   21 semester hours of professional education courses.

   In addition, students seeking teacher certification may count EDU 3103: Education in American Society toward the Core Curriculum requirement in Social and Behavioral Sciences (Domain II).

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 Core Curriculum requirements, is 133.

A. 53 semester hours of required courses in chemistry:

CHE 1103 General Chemistry
CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CHE 2203 Organic Chemistry I
CHE 2242 Organic Chemistry I Laboratory
CHE 2251 Organic Chemistry I Recitation
CHE 2303 Organic Chemistry II
CHE 2342 Organic Chemistry II Laboratory
CHE 2351 Organic Chemistry II Recitation
CHE 3103 Analytical Chemistry
CHE 3204 Physical Chemistry I
CHE 3212 Physical Chemistry Laboratory
CHE 3224 Physical Chemistry II
CHE 3243 Instrumental Analysis
CHE 3264 Descriptive Inorganic Chemistry
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. 6 additional semester hours of approved upper-division chemistry electives. No more than 3 semester hours may be from CHE 4913: Independent Study or CHE 4923: Special Project in Chemistry.

C. 23 semester hours of support work in science and mathematics:

1. 20 semester hours of required courses:

MAT 1214 Calculus I
MAT 1223 Calculus II
MAT 2213 Calculus III
or
CS 1723 Data Structures I
PHY 1904, 1911 Technical Physics I and Laboratory
PHY 1924, 1931 Technical Physics II and Laboratory

2. 3 additional hours of elective work from the College of Sciences and Engineering, as approved by the Advisor.

D. 3-4 semester hours in computer science:

CS 1073 Introductory Computer Programming for Scientific Applications
or
CS 1714 Introduction to Computer Science

E. 6 semester hours of electives.

BACHELOR OF ARTS DEGREE IN CHEMISTRY
(Coordinating Board approval pending)

The Bachelor of Arts degree in Chemistry is a less comprehensive degree in Chemistry than the Bachelor of Science degree. It provides opportunities for preparation for careers in industry, governmental agencies, environmental studies, and preprofessional programs. It is not recommended for students planning to pursue graduate studies in chemistry or related fields. It does not meet the criteria for an American Chemical Society-approved degree in Chemistry.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 124. All candidates for the degree must complete:

A. 37 semester hours of required courses in chemistry:

CHE	1103	General Chemistry
CHE	1303	Chemical Principles
CHE	1312	Inorganic Qualitative and Quantitative Analysis
CHE	2203	Organic Chemistry I
CHE	2242	Organic Chemistry I Laboratory
CHE	2251	Organic Chemistry I Recitation
CHE	2303	Organic Chemistry II
CHE	2342	Organic Chemistry II Laboratory
CHE	2351	Organic Chemistry II Recitation
CHE	3103	Analytical Chemistry
CHE	3124	Basic Physical Chemistry
CHE	3212	Physical Chemistry Laboratory
CHE	3243	Instrumental Analysis
CHE	3264	Descriptive Inorganic Chemistry
CHE	4971	Proseminar

B. 12 additional semester hours of approved upper-division chemistry electives. No more than 6 semester hours may be from CHE 4913: Independent Study or CHE 4923: Special Project in Chemistry.

C. 24-27 semester hours of support work in science and mathematics:

1. 15-18 semester hours of required courses:

MAT	1214	Calculus I
Either		
PHY	1603, 1611	General Physics I and Laboratory
PHY	1623, 1631	General Physics II and Laboratory
	or	
	PHY 1904, 1911	Technical Physics I and Laboratory
	PHY 1924, 1931	Technical Physics II and Laboratory
CS	1073	Introductory Computer Programming for Scientific Applications
	or	
	CS 1714	Introduction to Computer Science

2. 9 additional semester hours of approved electives from the College of Sciences and Engineering. Up to 6 semester hours may be outside the College (9 semester hours for students seeking teacher certification), with prior approval of the advisor.

D. 6 semester hours of electives.

MINOR IN CHEMISTRY

The purpose of this program is to permit students majoring in other areas to obtain a solid, broad-based knowledge of chemistry. The program is applicable to those students in other areas of science and in preprofessional programs.

22 semester hours are required for this minor:

CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CHE 2203 Organic Chemistry I
CHE 2242 Organic Chemistry I Laboratory
CHE 2303 Organic Chemistry II
CHE 2342 Organic Chemistry II Laboratory
CHE 3103 Analytical Chemistry
CHE 3264 Descriptive Inorganic Chemistry

To declare a minor in Chemistry, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Earth and Physical Sciences.

MINOR IN PHYSICAL CHEMISTRY

The purpose of this program is to permit students, especially those majoring in physics, engineering, and mathematics, to obtain a strong background in physical chemistry. The fundamentals in other areas of chemistry will also be studied.

21-22 semester hours are required for this minor:

A. 18 semester hours of required courses:

CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CHE 2203 Organic Chemistry I
CHE 3204 Physical Chemistry I
CHE 3212 Physical Chemistry Laboratory
CHE 3224 Physical Chemistry II

B. 3-4 additional semester hours, to be selected from the following:

CHE 3103 Analytical Chemistry
CHE 3264 Descriptive Inorganic Chemistry
CHE 4253 Physical Chemistry III

To declare a minor in Physical Chemistry, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Earth and Physical Sciences.

COURSE DESCRIPTIONS
CHEMISTRY
(CHE)

1003 Chemistry for Allied Health Sciences
(3-0) 3 hours credit.
Introduction to atomic structure, chemical bonding, stoichiometry, states of matter, inorganic chemical reactions, and acids and bases. For majors in Physical Therapy, Occupational Therapy, prenursing, and dental hygiene. May not be applied to a major in Chemistry, Biology, or Clinical Laboratory Sciences. Concurrent enrollment in CHE 1011 is recommended. [TCCN: CHEM 1305.]

1011 Chemistry Laboratory for Allied Health Sciences
(0-4) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in CHE 1003.
Introduction to chemical laboratory techniques. For majors in Physical Therapy, Occupational Therapy, prenursing, and dental hygiene. May not be applied to a major in Chemistry, Biology, or Clinical Laboratory Sciences. [TCCN: CHEM 1105.]

1053 Chemistry of Ordinary Things
(3-0) 3 hours credit.
An introduction to the fundamental concepts of chemistry and the study of the chemistry of life and the everyday world. For nonscience majors. May not be applied to a major in the natural sciences, engineering, or allied health sciences.

1103 General Chemistry
(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in MAT 1063.
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. Concurrent enrollment in CHE 1122 is recommended. [TCCN: CHEM 1311.]

1122 General Chemistry Laboratory Workshop
(1-4) 2 hours credit. Prerequisite: Completion of or concurrent enrollment in 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. [TCCN: CHEM 1111.]

1203 Elementary Organic and Biochemistry
(3-0) 3 hours credit. Prerequisites: CHE 1003 and 1011.
A survey of the structures and reactions of some important functional groups of organic chemistry and the relationship of these functional groups to the chemistry of lipids, carbohydrates, nucleic acids, and proteins. May not be applied to a major in Chemistry. Concurrent enrollment in CHE 1211 is recommended. (Formerly CHE 2103. Credit cannot be earned for both CHE 1203 and CHE 2103.)

1211 Organic and Biochemistry Laboratory
(0-4) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in CHE 1203.
Laboratory examination of the properties of some simple organic and biological chemicals; topics include solubility, crystallization, organic reactions, titration, enzyme action, sugars, and vitamins. May not be applied to a major in Chemistry. (Formerly CHE 2111. Credit cannot be earned for both CHE 1211 and CHE 2111.)

1303 Chemical Principles
(3-0) 3 hours credit. Prerequisite: At least a "C" in CHE 1103 or an equivalent.
A continuation of CHE 1103. Elementary inorganic and physical chemistry; topics include solutions, electrolytes, oxidation-reduction reactions, reaction trends, coordination chemistry, basic thermodynamics, chemical kinetics, and electrochemistry. Primarily for science majors. (Formerly CHE 2003. Credit cannot be earned for both CHE 1303 and CHE 2003.) [TCCN: CHEM 1312.]

1312 Inorganic Qualitative and Quantitative Analysis
(1-5) 2 hours credit. Prerequisite: Completion of or concurrent enrollment in CHE 1303.
Techniques of qualitative and quantitative chemical analysis, illustrated primarily via inorganic chemical systems and their reactions. (Formerly CHE 2012. Credit cannot be earned for both CHE 1312 and CHE 2012.) [TCCN: CHEM 1112.]

2203 Organic Chemistry I
(3-0) 3 hours credit. Prerequisites: CHE 1303 and 1312.
An elementary study of structure, stereochemistry, reactions, and reaction mechanisms associated with organic compounds. Primarily for chemistry, pre-med, and science majors. Concurrent enrollment in CHE 2242 and 2251 is recommended. [TCCN: CHEM 2323.]

2242 Organic Chemistry I Laboratory
(1-5) 2 hours credit. Prerequisite: Completion of or concurrent enrollment in CHE 2203. The first of two semesters of organic chemistry laboratory. Qualitative analysis and determination of the physical constants of organic compounds. Separation, identification, and elementary synthesis of organic compounds. Laboratory techniques (crystallization, distillation, chromatographic), and spectroscopic techniques (IR, NMR, MS) are emphasized. [TCCN: CHEM 2223.]

2251 Organic Chemistry I Recitation
(1-0) 1 hour credit. Prerequisite: Concurrent enrollment in CHE 2203.
A recitation section for discussion of problems amplifying and clarifying textual content of CHE 2203.

2303 Organic Chemistry II
(3-0) 3 hours credit. Prerequisites: CHE 2203, and completion of or concurrent enrollment in 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. [TCCN: CHEM 2325.]

2342 Organic Chemistry II Laboratory
(1-5) 2 hours credit. Prerequisites: CHE 2242, and completion of or concurrent enrollment in CHE 2303.
Quantitative and continuing qualitative study of organic reactions and molecular structure through functional group interactions and spectroscopic techniques. Simple and multistep syntheses of organic compounds. A continuation of CHE 2242. [TCCN: CHEM 2225.]

2351 Organic Chemistry II Recitation
(1-0) 1 hour credit. Prerequisite: Concurrent enrollment in CHE 2303.
A recitation section for discussion of problems amplifying and clarifying textual content of CHE 2303.

3103 Analytical Chemistry
(2-5) 3 hours credit. Prerequisites: CHE 1303 and 1312.
A detailed study of wet chemical and basic instrumental analysis, including gravimetric, volumetric, and spectrophotometric determinations.

3124 Basic Physical Chemistry
(3-2) 4 hours credit. Prerequisites: CHE 1303, 1312, MAT 1214, and either PHY 1623 and 1611 or 1924 and 1911.
A one-semester course covering some basic concepts of thermodynamics, chemical equilibria, kinetics, spectroscopy, and related topics. May not be applied to a Bachelor of Science degree in Chemistry.

3204 Physical Chemistry I
(4-0) 4 hours credit. Prerequisites: CHE 1303, 1312, MAT 1223, and PHY 1924 and 1931; completion of two semesters of organic chemistry is strongly 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: CHE 3124 or 3224.
Experimental study of thermodynamics and electrochemistry, spectroscopy, and reaction kinetics.

3224 Physical Chemistry II
(4-0) 4 hours credit. Prerequisite: CHE 3204.
Chemical kinetics, electrolytes and electrochemistry, elements of quantum mechanics, chemical bonds, spectroscopy, and photo-chemistry. A continuation of CHE 3204.

3243 Instrumental Analysis
(1-6) 3 hours credit. Prerequisites: CHE 2342, 3103, and completion of or concurrent enrollment in CHE 3124 or 3224.
Electrochemical methods; use of modern spectrometric and chromatographic instrumentation in separation, purification, and/or quantitative characterization of chemical systems.

3264 Descriptive Inorganic Chemistry
(3-3) 4 hours credit. Prerequisites: CHE 1303 and 1312.
The basic principles of inorganic chemistry applied to the properties, reactions, and periodicity of inorganic elements and compounds. Includes the synthesis and characterization of inorganic compounds and the use of specialized laboratory techniques.

4243 Organic Chemistry III
(3-0) 3 hours credit. Prerequisites: CHE 2303, 2342, and 2351; CHE 3204; or consent of instructor.
Advanced mechanistic and/or synthetic aspects of organic reactions; additional topics such as molecular rearrangements and organic molecular orbital theory and its application to pericyclic reactions.

4253 Physical Chemistry III
(3-0) 3 hours credit. Prerequisites: CHE 2303 and 3224, 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. Prerequisites: CHE 3204 and 3264.
A study of the structure, bonding, and properties of inorganic compounds; acid-base theory, crystalline state, coordination chemistry, and other advanced topics.

4373 Organic Spectral Studies
(3-0) 3 hours credit. Prerequisite: CHE 2342.
Identification of functional groups and the determination of the structure of compounds by spectral techniques including IR, NMR, mass spectroscopy, and UV-Vis absorption spectroscopy; basic theory of spectral measurements with emphasis on practical applications.

4403 Chemistry of Heterocyclic Compounds
(3-0) 3 hours credit. Prerequisite: CHE 2303 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 and 4243, 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) of the instructor, the student's advisor, and the Division Director and Dean of the College in which this course is offered.
Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students desiring specialized work.

May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4923 Special Project in Chemistry
(3-0) 3 hours credit. Prerequisite: Consent of Division Director (form available in Division office).
A special laboratory research or library readings project under the direction of a faculty member, resulting in a report. Limited to science majors in their final year of undergraduate study.

4953 Special Studies in Chemistry
(3-0) 3 hours credit. Prerequisites: Upper-division standing and consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4971 Proseminar
(0-3) 1 hour credit. Prerequisites: CHE 2303 and either 3204 or 3124.
Oral reports on current publications in chemistry and chemical technology, using important chemical reference materials and periodicals. May be repeated for credit when topics vary, but only 2 hours may be applied towards the degree.

4993 Honors Research
3 hours credit. Prerequisites: 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 only once with approval.

BACHELOR OF SCIENCE DEGREE IN GEOLOGY

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

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 133.

All candidates for the degree must complete:

A. 52 semester hours in geology:

1. 40 semester hours of required courses:

GEO 1103, 1111 Introduction to Earth Systems and Laboratory
GEO 1123, 1131 Earth History and Laboratory
GEO 2003, 2011 Mineralogy and Laboratory
GEO 2023, 2031 Optical Mineralogy and Laboratory

GEO 3043, 3052 Petrology and Laboratory
GEO 3063, 3071 Paleontology and Laboratory
GEO 3103, 3111 Structural Geology and Laboratory
GEO 3123, 3131 Sedimentary Geology and Laboratory
GEO 4947 Field Geology

2. 12 additional semester hours, to be selected from the following (a maximum of 3 hours of GEO 4911-3 or 4953 may apply to this requirement):

GEO 3083 Stratigraphy
GEO 3091 Stratigraphy Laboratory
GEO 3113 Geologic Field Investigations
GEO 3143 Economic Geology
GEO 3151 Economic Geology Laboratory
GEO 3163 Oceanography
GEO 3374 Geochemistry
GEO 3383 General Geophysics
GEO 4023 Engineering Geology
GEO 4063 Principles of Environmental Geology
GEO 4113 Geomorphology
GEO 4121 Geomorphology Laboratory
GEO 4623 Ground-Water Hydrology
GEO 4803 X-Ray Crystallography
GEO 4911-3 Independent Study
GEO 4953 Special Studies in Geology
GEO 4993 Honors Research

B. 26-29 required semester hours in the College of Sciences and Engineering:

CHE 1103 General Chemistry
CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CS 1073 Introductory Computer Programming for Scientific Applications
or
CS 1714 Introduction to Computer Science
MAT 1214 Calculus I
MAT 1223 Calculus II
Either
PHY 1904, 1911 Technical Physics I and Laboratory
PHY 1924, 1931 Technical Physics II and Laboratory
or
PHY 1603, 1611 General Physics I and Laboratory
PHY 1623, 1631 General Physics II and Laboratory

C. 9 semester hours of electives.

BACHELOR OF ARTS DEGREE IN GEOLOGY
(Coordinating Board approval pending)

The Bachelor of Arts degree in Geology provides opportunities for preparation for careers in fields such as the legal profession, insurance, financial services, and

environmental management. It is not recommended for students planning to pursue graduate studies in geology or related fields.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 126. All candidates for the degree must complete:

A. 40 semester hours of geology:

1. 28 semester hours of required courses:

GEO 1103, 1111 Introduction to Earth Systems and Laboratory
GEO 1123, 1131 Earth History and Laboratory
GEO 2003, 2011 Mineralogy and Laboratory
GEO 2023, 2031 Optical Mineralogy and Laboratory
GEO 3043, 3052 Petrology and Laboratory
GEO 3063, 3071 Paleontology and Laboratory
GEO 3113 Geologic Field Investigations

2. 12 additional semester hours, to be selected from the following (a maximum of 3 hours from either GEO 4911-3 or 4953 may apply to this requirement):

GEO 3083 Stratigraphy
GEO 3091 Stratigraphy Laboratory
GEO 3103 Structural Geology
GEO 3111 Structural Geology Laboratory
GEO 3123 Sedimentary Geology
GEO 3131 Sedimentary Geology Laboratory
GEO 3143 Economic Geology
GEO 3151 Economic Geology Laboratory
GEO 3163 Oceanography
GEO 3374 Geochemistry
GEO 3383 General Geophysics
GEO 4023 Engineering Geology
GEO 4063 Principles of Environmental Geology
GEO 4113 Geomorphology
GEO 4121 Geomorphology Laboratory
GEO 4623 Ground-Water Hydrology
GEO 4803 X-Ray Crystallography
GEO 4911-3 Independent Study
GEO 4953 Special Studies in Geology
GEO 4993 Honors Research

B. 23-24 semester hours in the College of Sciences and Engineering:

CHE 1103 General Chemistry
CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CS 1073 Introductory Computer Programming for Scientific Applications
or
CS 1714 Introduction to Computer Science
MAT 1214 Calculus I
PHY 1603, 1611 General Physics I and Laboratory
PHY 1623, 1631 General Physics II and Laboratory

C. 12 semester hours of electives.

MINOR IN GEOLOGY

All students pursuing the minor in Geology must complete 21 semester hours:

GEO	1123, 1131	Earth History and Laboratory
GEO	2003, 2011	Mineralogy and Laboratory
GEO	2023, 2031	Optical Mineralogy and Laboratory
GEO	3043, 3052	Petrology and Laboratory
GEO	3063, 3071	Paleontology and Laboratory

To declare a minor in Geology, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Earth and Physical Sciences.

COURSE DESCRIPTIONS
GEOLOGY
(GEO)

1013 The Third Planet
(3-0) 3 hours credit.
Evolution of ideas concerning the earth's origin, structure and age; social impact of recognizing the antiquity of the planet and humankind's brief presence; examination of how the distribution of planetary resources influenced the rise and clash of civilizations. May not be applied to a major in Geology.

1103 Introduction to Earth Systems
(3-0) 3 hours credit.
The earth as a dynamic planet; relation of Earth's present day processes to its resources, structure, and internal composition. Nature of minerals and rocks, the hydrosphere, tectonics, earthquakes, volcanism, and surface features of Earth. Concurrent enrollment in GEO 1111 recommended. (Formerly GEO 1003. Credit cannot be earned for both GEO 1103 and GEO 1003.) [TCCN: GEOL 1303.]

1111 Introduction to Earth Systems Laboratory
(0-3) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in GEO 1103.
Relation of Earth's present-day processes to its resources, structure, and internal composition. Field trips and laboratory study of minerals, rocks, maps, and aerial and satellite photos. (Formerly GEO 1011. Credit cannot be earned for both GEO 1111 and GEO 1011.) [TCCN: GEOL 1103.]

1123 Earth History
(3-0) 3 hours credit.
Formation and evolution of the earth, its life forms, and the major features of its surface. Concurrent enrollment in GEO 1131 recommended. (Formerly GEO 1023. Credit cannot be earned for both GEO 1123 and GEO 1023.) [TCCN: GEOL 1304.]

1131 Earth History Laboratory
(0-3) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in GEO 1123.
Laboratory study of fossils and rock sequences; interpretation of earth history. (Formerly GEO 1031. Credit cannot be earned for both GEO 1131 and GEO 1031.) [TCCN: GEOL 1104.]

2003 Mineralogy
(3-0) 3 hours credit. Prerequisites: GEO 1103 and 1111, MAT 1093, CHE 1103, or consent of instructor; concurrent enrollment in GEO 2011.
Crystallography, chemistry, physical properties, and origins of minerals.

2011 Mineralogy Laboratory
(0-3) 1 hour credit. Prerequisite: Concurrent enrollment in GEO 2003.
Laboratory study of crystal models, crystals, and minerals.

2023 Optical Mineralogy
(3-0) 3 hours credit. Prerequisites: GEO 2003, 2011, and concurrent enrollment in GEO 2031.
Principles and methods of optical mineralogy. Optical properties of minerals and microscopic determination of opaque and non-opaque minerals.

2031 Optical Mineralogy Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 2003, 2011, and concurrent enrollment in GEO 2023.
Use of the petrographic microscope for the identification of minerals.

3043 Petrology
(3-0) 3 hours credit. Prerequisites: GEO 2023, 2031, and concurrent enrollment in 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, 2031, and concurrent enrollment in GEO 3043.
Laboratory study of rocks in hand specimen and thin section.

3063 Paleontology
(3-0) 3 hours credit. Prerequisites: GEO 1103, 1111, 1123, 1131, or consent of instructor; concurrent enrollment in GEO 3071.
Study of fossil animals and plants. Emphasis on invertebrate animals. Systematics, biostratigraphy, paleoecology, and evolution of fossil organisms. Field trips required.

3071 Paleontology Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 1103, 1111, 1123, 1131, and concurrent enrollment in GEO 3063.
Study of fossil specimens, collections, and preparation techniques. Field trips required.

3083 Stratigraphy
(3-0) 3 hours credit. Prerequisites: GEO 3063, 3071, 3123, and 3131, or consent of instructor; concurrent enrollment in GEO 3091.
Application of geologic principles to the interpretation of rocks formed at or near the surface of the earth. Field trips required.

3091 Stratigraphy Laboratory
(0-3) 1 hour credit. Prerequisite: Concurrent enrollment in GEO 3083.
Laboratory study of stratigraphic methods using maps, measured sections, geologic and stratigraphic cross-sections, air photos, seismic data, modeling techniques, and systems analysis, and various aspects of sequence stratigraphic analysis.

3103 Structural Geology
(3-0) 3 hours credit. Prerequisites: GEO 3043, 3052, and concurrent enrollment in GEO 3111.
Response of earth materials to natural stresses. Description and origin of geologic structures. Field trips required.

3111 Structural Geology Laboratory
(0-3) 1 hour credit. Prerequisite: Concurrent enrollment in GEO 3103.
Laboratory study of geologic structures using maps, cross-sections, air photos, and descriptive geometric and stereographic methods.

3113 Geologic Field Investigations
(0-6) 3 hours credit. Prerequisite: Consent of instructor.
Field studies of areas of geologic interest; e.g., structural geologic mapping, sedimentary facies analysis, hydrologic studies, etc. May be repeated for credit when topics vary, but not more than 6 credit hours may be applied to a B.A. or B.S. degree in Geology. Concurrent enrollment in GEO 4947 is not permitted. May be offered during summer session.

3123 Sedimentary Geology
(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in GEO 3043 and 3052; concurrent enrollment in GEO 3131.
Processes of erosion, transportation, and deposition that form bodies of sedimentary rock. Depositional systems and modeling are a significant area of study. Field trips required.

3131 Sedimentary Geology Laboratory
(0-3) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in GEO 3043, 3052, and 3123.
Laboratory studies of sedimentary processes and their products. Hand specimens, thin sections, sedimentary structures, and interpretation of depositional environments. Field trips required.

3143 Economic Geology
(3-0) 3 hours credit. Prerequisites: GEO 2003, 2011, and concurrent enrollment in GEO 3151.
Origin of metallic ore deposits and industrial minerals, including the geology of major metallic deposits and the uses and economics of metals. Field trips required.

3151 Economic Geology Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 3043, 3052, and concurrent enrollment in GEO 3143.
Study of rock and mineral suites from important ore localities. Identification of ore minerals. Textures, structures, and alteration zones associated with ore deposits.

3163 Oceanography
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
General oceanography, with emphasis on marine geology and especially the continental margins.

3374 Geochemistry
(2-4) 4 hours credit. Prerequisite: CHE 1303 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. (Formerly GEO 3373. Credit cannot be earned for both GEO 3374 and GEO 3373.)

3383 General Geophysics
(3-0) 3 hours credit. Prerequisites: GEO 3043 and 3052.
Physics of the earth's interior, plate tectonics, geomagnetism, gravity, and heat flow.

4023 Engineering Geology
(3-0) 3 hours credit. Prerequisites: PHY 1904 or PHY 1603; MAT 1214; or consent of instructor.
Geologic factors in construction. Geotechnical properties of minerals, rocks, and soils. Case studies. Field trips required. (Formerly GEO 3023. Credit cannot be earned for both GEO 4023 and GEO 3023.)

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 1103, 1111, and concurrent enrollment in GEO 4121.
Analysis of Cenozoic landform evolution.

4121 Geomorphology Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 1103, 1111, and concurrent enrollment in GEO 4113.
Interpretation of maps and aerial photographs.

4623 Ground-Water Hydrology
(3-0) 3 hours credit. Prerequisites: GEO 1103, 1111, and PHY 1904; or PHY 1603 and MAT 1214.
Hydrologic cycle and the theory of underground water. Recharge and discharge of aquifers; water quality; exploration and development of ground-water supplies. Field trips required.

4803 X-Ray Crystallography
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
The principles and applications of x-ray diffraction to crystalline materials.

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 desiring specialized work. May be repeated for credit, but not more than 3 hours will apply to a bachelor's degree in Geology.

4947 Field Geology
(6-12) 7 hours credit. Prerequisites: GEO 3103, 3111, and consent of instructor.
Field mapping and measurements during a seven-week period in summer.

4953 Special Studies in Geology
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research
3 hours credit. Prerequisites: 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 only once with approval.

BACHELOR OF SCIENCE DEGREE IN PHYSICS

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

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 133.

All candidates for the degree must complete:

A. 49 semester hours:

1. 40 semester hours of required courses:

PHY 1904, 1911 Technical Physics I and Laboratory
PHY 1924, 1931 Technical Physics II and Laboratory
PHY 3103 Modern Physics
PHY 3133 Computers in the Physics Laboratory

PHY 3203 Classical Mechanics I
PHY 3293 Statistical Thermodynamics
PHY 3343 Advanced Physics Laboratory I
PHY 3353 Advanced Physics Laboratory II
PHY 3423 Electricity and Magnetism
PHY 3443 Optics
PHY 3823 Mathematical Physics
PHY 4263 Quantum Mechanics I

2. 9 additional approved semester hours, to be selected from the following (a maximum of 3 hours from either PHY 4911-3 or 4953 may apply to this requirement):

PHY 3163 Theoretical Physics
PHY 3313 Solid State Physics
PHY 3433 Introduction to the Theory of Solid State Electronics
PHY 3453 Lasers: Theory and Applications
PHY 4133 Numerical Methods for Physicists
PHY 4203 Classical Mechanics II
PHY 4423 Quantum Mechanics II
PHY 4911-3 Independent Study
PHY 4953 Special Studies in Physics
PHY 4993 Honors Research

B. 30 semester hours required in the College of Sciences and Engineering:

1. 27 semester hours of required courses (excluding physics):

CHE 1103 General Chemistry
CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CS 1073 Introductory Computer Programming for Scientific Applications
MAT 1214 Calculus I
MAT 1223 Calculus II
MAT 2213 Calculus III
MAT 2233 Linear Algebra
MAT 3613 Differential Equations I

2. 3 additional approved semester hours in the College of Sciences and Engineering.

BACHELOR OF ARTS DEGREE IN PHYSICS (Coordinating Board approval pending)

The Bachelor of Arts degree in Physics provides opportunities for careers in several professional fields. It is not recommended for students planning to pursue graduate studies in physics or related fields.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 124.

A. 28 semester hours:

1. 25 semester hours of required courses:

PHY 1904, 1911 Technical Physics I and Laboratory
PHY 1924, 1931 Technical Physics II and Laboratory
PHY 3103 Modern Physics
PHY 3133 Computers in the Physics Laboratory
PHY 3203 Classical Mechanics
PHY 3343 Advanced Physics Laboratory I
PHY 3423 Electricity and Magnetism

2. 3 additional semester hours, to be selected from the following:

PHY 3163 Theoretical Physics
PHY 3293 Statistical Thermodynamics
PHY 3313 Solid State Physics
PHY 3443 Optics
PHY 3823 Mathematical Physics
PHY 4133 Numerical Methods for Physicists
PHY 4263 Quantum Mechanics

B. 42 semester hours required in the College of Sciences and Engineering:

1. 27 semester hours of required courses (excluding physics):

CHE 1103 General Chemistry
CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CS 1073 Introductory Computer Programming for Scientific Applications
MAT 1214 Calculus I
MAT 1223 Calculus II
MAT 2213 Calculus III
MAT 2233 Linear Algebra
MAT 3613 Differential Equations I

2. 15 additional approved semester hours from the College of Sciences and Engineering.

MINOR IN PHYSICS

All students pursuing the minor in Physics must complete 22 semester hours:

A. 19 semester hours of required courses:

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

B. 3 semester hours, to be selected from the following:

PHY 3133 Computers in Physics Laboratory
PHY 3163 Theoretical Physics
PHY 3293 Statistical Thermodynamics
PHY 3313 Solid State Physics
PHY 3443 Optics
PHY 3823 Mathematical Physics
PHY 4133 Numerical Methods for Physicists
PHY 4263 Quantum Mechanics

To declare a minor in Physics, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Earth and Physical Sciences.

COURSE DESCRIPTIONS
PHYSICS
(PHY)

1014 Introduction to Physical Sciences
(3-1) 4 hours credit. Prerequisite: MAT 1063.
Major scientific discoveries since the Renaissance and their impact on the development of culture. May not be applied toward a B.S. or B.A. degree in Physics.

1603 General Physics I
(3-0) 3 hours credit. Prerequisite: MAT 1063 or an equivalent.
Motion, forces, conservation of energy and momentum, fluids, wave motion, and heat. Concurrent enrollment in PHY 1611 recommended. [TCCN: PHYS 1301.]

1611 General Physics I Laboratory
(0-3) 1 hour credit. Prerequisites: Completion of or concurrent enrollment in PHY 1603; proficiency in DOS, spreadsheets, and word processing.
Laboratory to accompany PHY 1603. [TCCN: PHYS 1101.]

1623 General Physics II
(3-0) 3 hours credit. Prerequisites: PHY 1603 and MAT 1063.
Electrostatics, electromagnetism, light, sound, and atomic and nuclear physics. Concurrent enrollment in PHY 1631 recommended. [TCCN: PHYS 1302.]

1631 General Physics II Laboratory
(0-3) 1 hour credit. Prerequisites: Completion of or concurrent enrollment in PHY 1623; proficiency in DOS, spreadsheets, and word processing.
Laboratory to accompany PHY 1623. [TCCN: PHYS 1102.]

1904 Technical Physics I
(4-0) 4 hours credit. Prerequisite: MAT 1214.
The basic concepts and methods of physics. Mechanics, heat, and fluids. Concurrent enrollment in PHY 1911 and MAT 1223 recommended. [TCCN: PHYS 2425.]

1911 Technical Physics I Laboratory
(0-3) 1 hour credit. Prerequisites: Completion of or concurrent enrollment in PHY 1904; proficiency in DOS, spreadsheets, and word processing.
Laboratory to accompany PHY 1904. [TCCN: PHYS 2125.]

1924 Technical Physics II
(4-0) 4 hours credit. Prerequisites: PHY 1904 and completion of or concurrent enrollment in MAT 1223.
Electricity and magnetism, wave phenomena, and elements of modern physics. Concurrent enrollment in PHY 1931 is recommended. [TCCN: PHYS 2426.]

1931 Technical Physics II Laboratory
(0-3) 1 hour credit. Prerequisites: Completion of or concurrent enrollment in PHY 1924; proficiency in DOS, spreadsheets, and word processing.
Laboratory to accompany PHY 1924. [TCCN: PHYS 2126.]

3103 Modern Physics
(3-0) 3 hours credit. Prerequisite: PHY 1924.
Special relativity, Planck's Radiation Law, elements of quantum mechanics, atomic and molecular structures, spectra, the atomic nucleus, nuclear reactions, and an introduction to elementary particles.

3133 Computers in the Physics Laboratory
(3-0) 3 hours credit. Prerequisites: PHY 1924, 1931, and 3103.
Topics covered include i80x86 assembly language programming, the FORTH programming environment, construction of customized computer interfaces to equipment, writing DOS/Windows device drivers for scientific instrumentation, and computer-controlled data acquisition and analysis.

3163 Theoretical Physics
(3-0) 3 hours credit. Prerequisites: PHY 1924 and MAT 2213.
Methods of theoretical physics applied to problems in electromagnetism and quantum and statistical physics, with an emphasis on physical formulation and interpretation.

3203 Classical Mechanics I
(3-0) 3 hours credit. Prerequisites: PHY 1924, and completion of or concurrent enrollment in PHY 3103 and MAT 2213.
Kinematics and dynamics of systems of particles; rigid body motion. Applications are emphasized.

3293 Statistical Thermodynamics
(3-0) 3 hours credit. Prerequisites: PHY 1924, 3103, and MAT 2213.
Fundamentals of thermodynamics: entropy, free energy, phase transitions, and thermodynamic potentials; equilibrium Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distribution functions; derivation of macroscopic equilibrium thermodynamics from statistical mechanics.

3313 Solid State Physics
(3-0) 3 hours credit. Prerequisite: PHY 3103.
Crystalline structures, phonons, energy bands, and semiconductor crystals.

3343 Advanced Physics Laboratory I
(0-6) 3 hours credit. Prerequisites: PHY 1924 and 1931.
Laboratory experience in the areas of optics, modern physics, and solid state and surface physics. (Formerly PHY 3346. Credit cannot be earned for both PHY 3343 and PHY 3346.)

3353 Advanced Physics Laboratory II
(0-6) 3 hours credit. Prerequisite: PHY 3343.
A continuation of PHY 3343. (Formerly PHY 3356. Credit cannot be earned for both PHY 3353 and PHY 3356.)

3423 Electricity and Magnetism
(3-0) 3 hours credit. Prerequisites: PHY 1924, and completion of or concurrent enrollment in 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 3103 and 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.
The reflection, refraction, absorption, polarization, and diffraction of light. Filters, lasers, non-linear properties, and Fourier optics.

3453 Lasers: Theory and Applications
(3-0) 3 hours credit. Prerequisite: PHY 3103.
Basic principles and designs of lasers: the Einstein A and B coefficients; the semi-classical laser theory; the phase-coherent nature of the stimulated emission process; and laser efficiency. Various applications of lasers; e.g., laser-induced fluorescence, light wave communications, holography, surgery, laser fusion, etc.

3823 Mathematical Physics
(3-0) 3 hours credit. Prerequisite: MAT 2233.
Complex variable theory, partial differential equations of physics, special functions, and approximation techniques.

4133 Numerical Methods for Physicists
(3-0) 3 hours credit. Prerequisites: PHY 1924, MAT 3613, and knowledge of either the "C" or "C++" programming language.
Topics covered include numerical integration of functions, solution of linear algebraic equations, matrices, Monte Carlo methods, root finding, minimization and maximization of functions, fast Fourier and discrete wavelet transform methods, and solution of differential equations.

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

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

4423 Quantum Mechanics II
(3-0) 3 hours credit. Prerequisite: PHY 4263.
The interaction of radiation with atomic systems, laser oscillations, band theory of electrons in crystals, and charge transport.

4911-3 Independent Study
1-3 hours credit. 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 desiring specialized work. May be repeated for credit, but not more than 3 hours will apply to a bachelor's degree in Physics.

4953 Special Studies in Physics
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research
3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during their last two semesters; approval by the College Honors Committee.
Supervised research and preparation of an honors thesis. May be repeated once with approval.

COURSE DESCRIPTIONS
ASTRONOMY
(AST)

1013 Introduction to Astronomy
(3-0) 3 hours credit. Prerequisite: MAT 1063.
A descriptive course including the development of astronomy, its methods, and the motions, laws, and evolution of the solar system. Topics include 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. [TCCN: PHYS 1311.]

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. [TCCN: PHYS 1111.]

COURSE DESCRIPTIONS
ENVIRONMENTAL-NATURAL RESOURCES
(ENV)

2013 Introduction to Environmental Systems
(3-0) 3 hours credit.
An introduction to the principles of man-machine-community interrelationships within the natural and built environments. General attention is given to the concepts of "growth," "processes," and "changes" occurring in ecosystems and social structures. Emphasis is placed on understanding system dynamics and how these relate to public policy formulation and natural resource use.

3023 Man and His Natural Resources
(3-0) 3 hours credit.
An in-depth analysis of man's dependency upon the major natural resources of the earth such as water, air, soils, forests, grasslands, minerals, fuels, and wildlife, and the environmental problems that arise through societal mismanagement.

DIVISION OF ENGINEERING

The Division of Engineering offers Bachelor of Science degrees in Civil, Electrical, and Mechanical Engineering. Each program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET/EAC). Individuals enrolling in these degree programs are given an opportunity to develop a strong background in the engineering sciences and to learn the analysis, design, and synthesis tools necessary to function well as active participants in many traditional, new, and emerging areas of high technology.

The Division has excellent laboratory facilities where students receive hands-on instruction by our faculty. Computer-aided design (CAD) facilities including "state of the art" workstations are routinely used in all programs. Some classes are taught by adjunct faculty from local industries, giving students the opportunity to interact with engineering professionals engaged in relevant engineering practice.

This quality engineering education is complemented by the Core Curriculum. Graduates from the Division of Engineering should have excellent opportunities for employment and for pursuing graduate degrees.

DEGREE REQUIREMENTS COMMON TO ALL PROGRAMS

Entering students should enroll in a specific engineering program by selecting either civil, electrical, or mechanical engineering as a major. Undecided engineering students should select a major closest to their area of interest (refer to the following program descriptions). Students may obtain additional information about each program from the Division office and/or a faculty advisor in the appropriate discipline. Since the first year of study is the same for all engineering programs, changing majors in the first year normally can be accomplished with no loss of credit.

Prerequisites for CE, EE, ME, and EGR courses must be completed with a grade of "C" or better. Students must satisfy the University's Core Curriculum and ABET accreditation requirements. Recommended degree plans and current ABET requirements may be obtained from the Division of Engineering.

Requirements common to all engineering degree programs are given below.

I. **Core Curriculum requirements:** Students seeking the Bachelor of Science degree in any engineering field must fulfill University Core Curriculum requirements by taking the following courses or their equivalents:

Rhetoric (6 semester hours)*

Domain I: Science, Technology, and Mathematics

Mathematics (4 semester hours):
MAT 1214 Calculus I

Science (7 semester hours):
CHE 1103 General Chemistry
PHY 1904 Technical Physics I

Computer Science/Logic (3 semester hours):
CS 2073 Programming with Engineering Applications

Domain II: Society and Culture

United States History and Diversity (6 semester hours)*
Political Studies (6 semester hours)*
Economics (3 semester hours):
EGR 3713 Engineering Economic Analysis

Social and Behavioral Sciences (incorporated in Domain IV)

Domain III: Literature, the Arts, and Language

Language (semester hours vary)*
Literature (incorporated in Domain IV)
The Arts (incorporated in Domain IV)

Domain IV: Interdisciplinary Studies

Diversity of Thought (3 semester hours). One of the following:
CE 4813 Civil Engineering Design
EE 4813 Electrical Engineering Design
ME 4813 ME Design Project

Diversity of Culture (6 semester hours):
IDS 2203 World Civilization to the Fifteenth Century
COR 2213 Engineering and Civilization

*Engineering students meet this section of the Core Curriculum in the same way as other UTSA students, as indicated in the description of the Core Curriculum in the Bachelor's Degree Regulations chapter of this catalog.

II. General Engineering Requirements:

All degree-seeking candidates in engineering must complete the following 38 semester hours (CHE 1103, PHY 1904, MAT 1214, CS 2073, and EGR 3713 also satisfy 16 hours of the Core Curriculum):

CHE	1103	Introductory Chemistry
CHE	1303	Chemical Principles
CS	2073	Programming with Engineering Applications
EGR	1301	Introduction to Engineering Problems
EGR	1402	Engineering Graphical Communications
EGR	3713	Engineering Economic Analysis
MAT	1214	Calculus I
MAT	1223	Calculus II
MAT	2213	Calculus III
MAT	3253	Engineering Analysis I
PHY	1904, 1911	Technical Physics I and Laboratory
PHY	1924, 1931	Technical Physics II and Laboratory

COURSE DESCRIPTIONS
ENGINEERING
(EGR)

1203 Science, Technology, and Society
(3-0) 3 hours credit.
History, meaning, and effects of the scientific method on our world. Technology assessed as a composite of applied science and human needs. Review of ethical implications of technologies and educational requirements for a technology-dominated future.

1213 Consumer Technology
(3-0) 3 hours credit. Prerequisite: MAT 1063.
Engineering and technological principles chosen from audio, communication, computer, transportation, video, and other applications. Concurrent enrollment in EGR 1221 recommended.

1221 Consumer Technology Laboratory
(0-3) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in EGR 1213.
Laboratory to accompany EGR 1213.

1301 Introduction to Engineering Problems
(1-0) 1 hour credit.
Engineering as a career; engineering ethics; and approaches to engineering problem solving through the use of engineering principles.

1402 Engineering Graphical Communications
(1-3) 2 hours credit. Prerequisite: Completion of or concurrent enrollment in MAT 1214.
Technical communication, engineering graphics, and an introduction to computer-aided graphics. Introduction to engineering analysis, design synthesis, and production methods.

2203 Statics
(3-0) 3 hours credit. Prerequisites: EGR 1301, EGR 1402, MAT 1223, and PHY 1904.
Vector algebra, force systems, and free body diagrams. Engineering applications of equilibrium, centroids, and moments of inertia. [TCCN: ENGR 2301.]

2213 Engineering Mechanics
(3-0) 3 hours credit. Prerequisites: EGR 1301, EGR 1402, MAT 1223, and PHY 1904.
Force systems, moments, equilibrium, kinematics, and kinetics of particles and plane rigid bodies. Not open to students majoring in Civil or Mechanical Engineering. May not be substituted for EGR 2203 or EGR 2503.

2503 Dynamics
(3-0) 3 hours credit. Prerequisites: EGR 2203, and completion of or concurrent enrollment in MAT 2213.
Kinematics and kinetics of particles and plane rigid bodies, work and energy, impulse and momentum, and engineering applications. [TCCN: ENGR 2302.]

3213 Mechanics of Solids
(3-0) 3 hours credit. Prerequisite: EGR 2203.
Internal forces and deformations in solids; stress, strain, and their relations; stresses and deflections in beams column theory and analysis; and engineering applications.

3713 Engineering Economic Analysis
(3-0) 3 hours credit. Prerequisite: Upper-division standing in the Division of Engineering.
Fundamentals of economics and economic policies. Techniques of economic analysis for engineering decisions, economic evaluation, and risk assessment. (Formerly EGR 4713. Credit cannot be earned for both EGR 3713 and EGR 4713.)

4723 Intelligent Robotics
(3-0) 3 hours credit. Prerequisites: EE 2213 or EE 2423, and completion of or concurrent enrollment in ME 4522 or EE 3413.
Theory and industrial application of robots; sensing; and artificial intelligence. (Formerly ME 4713. Credit cannot be earned for both EGR 4723 and ME 4713.)

4953 Special Studies in Engineering
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research
3 hours credit. Prerequisites: 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.

BACHELOR OF SCIENCE DEGREE IN CIVIL ENGINEERING

The B.S. degree program in Civil Engineering is a broad-based program designed to prepare students for careers in areas traditionally associated with civil engineering as well as several modern areas of high technology. Students are required to take courses in subjects related to environmental and water resources issues, structural analysis and design methodology, civil engineering materials such as reinforced concrete and steel, and geotechnical engineering. In addition, elective courses are available to provide emphasis on urban engineering, transportation systems, structures made with advanced composite materials, construction, and

other areas. Upon graduation from the UTSA Civil Engineering program, successful students should be qualified to seek employment in local or national companies and government agencies associated with aerospace, automotive and transportation, environmental, structural, geotechnical, and other industries.

A. 54 hours of required courses:

CE	2113	Plane Surveying
CE	3113	Structural Analysis
CE	3213	Reinforced Concrete Design
CE	3233	Steel Design
CE	3243	Properties and Behavior of Engineering Materials
CE	3413	Geotechnical Engineering
CE	3603	Hydraulic Engineering
CE	3633	Water and Wastewater Treatment
CE	3713	Civil Engineering Systems Analysis
CE	4603	Water Resources Engineering
CE	4813	Civil Engineering Design*
EE	2213	Electric Circuits and Electronics
EGR	2203	Statics
EGR	2503	Dynamics
EGR	3213	Mechanics of Solids
ENG	2413	Technical Writing
GEO	4023	Engineering Geology
ME	3283	Fundamentals of Thermal Sciences

*May be used in satisfying the Core Curriculum requirements in Domain IV.

B. 9 hours of civil engineering electives, 6 of which must be selected from the following list:

CE	4113	Transportation Systems
CE	4223	Earth Structures
CE	4323	Urban Engineering Design
CE	4413	Foundation Engineering
CE	4523	Advanced Reinforced Concrete Design
CE	4543	Construction Planning
CE	4623	Municipal and Rural Sanitation
CE	4643	Air Pollution and Industrial Hygiene
CE	4653	Design of Water Pollution Control Systems
CE	4723	Hydraulic Systems Design

COURSE DESCRIPTIONS
CIVIL ENGINEERING
(CE)

2113 Plane Surveying
(2-3) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in MAT 1214.
Plane surveying procedures: chaining, leveling, and measuring angles; applications: balancing traverses, constructing control networks, determining state plane coordinates, horizontal and vertical curves, and property boundaries.

3113 Structural Analysis
(3-0) 3 hours credit. Prerequisite: EGR 3213.
Forces and deflections in structural systems, considering stationary and moving loads and exact and approximate methods.

3213 Reinforced Concrete Design
(2-3) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in CE 3113.
Ultimate strength theory and design for reinforced concrete members.

3233 Steel Design
(2-3) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in 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. Prerequisites: EGR 3213 and ENG 2413.
Structure, properties, and behavior of engineering materials; measurement and analysis of material properties and behavior. Laboratory exercises illustrate typical material behavior and selected principles of mechanics.

3413 Geotechnical Engineering
(2-3) 3 hours credit. Prerequisite: EGR 3213.
Fundamental properties of soil and rock. Flow through porous media. The effective stress principle and computation of *in-situ* stress distributions. Strength and compressibility of geotechnical materials. (Formerly CE 4213. Credit cannot be earned for both CE 3413 and CE 4213.)

3603 Hydraulic Engineering
(2-3) 3 hours credit. Prerequisite: EGR 2503.
Fluid properties, fluid statics concepts, and equations of fluid flow in pipes and open channels. Flow through porous media.

3633 Water and Wastewater Treatment
(2-3) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in CE 3603.
The application of chemical, biochemical, physical, and mathematical processes to water treatment, wastewater treatment, and pollution control. (Formerly CE 4633. Credit cannot be earned for both CE 3633 and CE 4633.)

3713 Civil Engineering Systems Analysis
(3-0) 3 hours credit. Prerequisites: CS 2073, MAT 3253, and EGR 3713.
Introduction to systems approach to problem solving. Application of operations research in civil engineering; mathematical modeling and analysis techniques, including marginal analysis, linear programming, and dynamic programming. (Formerly CE 4713. Credit cannot be earned for both CE 3713 and CE 4713.)

3723 Surface Water Hydrology
(3-0) 3 hours credit. Prerequisites: CE 3603 or consent of instructor.
Hydrologic cycle, precipitation, hydrologic abstractions, surface runoff; unit hydrographs, synthetic hydrographs; peak discharge relationships;

flood frequency analysis; flood and reservoir routing; urban hydrology and stormwater management.

4113 Transportation Systems
(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in EGR 3713.
Planning, design, construction, operation, and maintenance of transportation systems; concepts of various modes of transportation.

4123 Highway Engineering
(3-0) 3 hours credit. Prerequisite: Senior standing in Civil Engineering. General characteristics of highway design. Horizontal and vertical alignment, cross sections, earthwork, drainage, and pavement. Economic analysis.

4223 Earth Structures
(2-3) 3 hours credit. Prerequisite: CE 3413.
Stability, strength, and deformation characteristics of engineering structures in and on geotechnical materials.

4313 Computer-Aided Design in Civil Engineering
(2-3) 3 hours credit. Prerequisite: Senior standing in Civil Engineering. Organization and programming of Civil Engineering problems for computer solutions. Application of commercially available design software.

4323 Urban Engineering Design
(2-3) 3 hours credit. Prerequisite: CE 3713.
Planning, analysis, and design of civil engineering systems for the urban environment, public transportation, traffic, and water supply and treatment. Projection of growth patterns, financing prioritization, and implementation. Integration of public and private sector facilities.

4413 Foundation Engineering
(3-0) 3 hours credit. Prerequisite: CE 3413.
Design of foundations and earth-retaining structures; study of earth-pressure theories.

4513 Advanced Structural Analysis
(3-0) 3 hours credit. Prerequisite: CE 3113.
Digital computer analysis of linear structural systems. Theoretical basis for modern computer programs. Application of several standard programs for a variety of structures.

4523 Advanced Reinforced Concrete Design
(2-3) 3 hours credit. Prerequisite: CE 3213.
Design of reinforced concrete buildings by ultimate strength methods; pre-stressed concrete design.

4543 Construction Planning
(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in EGR 3713.
Planning and managing, scheduling, and control of construction projects. Topics include management functions, network techniques, equipment

selection, management and operation, construction financing, bidding strategy, risk assessment, cost control, and projection.

4603 Water Resources Engineering
(2-3) 3 hours credit. Prerequisite: CE 3603.
Analysis and design of surface and subsurface water resource systems; dam and reservoir design for recharge, flood control, and water supply; and design of water supply, wastewater collection, and stormwater systems.

4623 Municipal and Rural Sanitation
(3-0) 3 hours credit. Prerequisite: CE 3603.
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. (Formerly CE 3673. Credit cannot be earned for both CE 4623 and CE 3673.)

4643 Air Pollution and Industrial Hygiene
(2-3) 3 hours credit. Prerequisites: CHE 1303 and senior standing in Civil Engineering.
Discussion of the sources, quantities, effects of sampling, and control of airborne pollutants in ambient air, and in urban and industrial environments. (Formerly AS 4643. Credit cannot be earned for both CE 4643 and AS 4643.)

4653 Design of Water Pollution Control Systems
(2-3) 3 hours credit. Prerequisite: CE 3633.
Analysis, synthesis, design, and system optimization of integrated processes and operations to handle and treat water and wastewater.

4723 Hydraulic Systems Design
(3-0) 3 hours credit. Prerequisites: CE 3603, MAT 3253, and senior standing in Civil Engineering; or consent of instructor.
Hydraulic structure design, culverts, transitions, and energy dissipators; stable channel design and sediment transport; receiving water quality analysis, dispersion, advective and reactive considerations; and hydraulic and water quality simulation models.

4813 Civil Engineering Design
(2-3) 3 hours credit. Prerequisites: CE 3213, 3233, 3413, 3603, 3633, and 3713.
Opportunity to apply design skills to execution of an open-ended integrated civil engineering design project, including field and laboratory investigations, numerical and scale modeling, design, and formal oral and written presentation of results. Considers safety, reliability, environmental, economic, and other constraints. Ethical and social impacts.

4911-3 Independent Study
1-3 hours credit. Prerequisite: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.
Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to a bachelor's degree.

4953 Special Studies in Civil Engineering
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

The B.S. degree program in Electrical Engineering offers students the opportunity to prepare for careers in areas associated with electronics, digital systems, computer architecture and design, communications, controls and robotics, computer-aided design (CAD), instrumentation, bioengineering, and other traditional and emerging areas of high technology. Through the proper selection of elective courses to augment required courses, successful students may develop a specialization pertinent to many of these areas, which may lead to employment with electronic companies, high-technology industries, and government agencies.

A. 54 semester hours of required courses:

1. 45 semester hours of electrical engineering:

EE	2423	Network Theory
EE	2513	Logic Design
EE	3113	Electrical Engineering Laboratory I
EE	3213	Electromagnetic Engineering
EE	3313	Electronic Circuits I
EE	3413	Analysis and Design of Control Systems
EE	3423	Network Analysis
EE	3463	Microcomputer Systems I
EE	3513	Electromechanical Systems
EE	3563	Digital Systems Design I
EE	4113	Electrical Engineering Laboratory II
EE	4313	Electronic Circuits II
EE	4613	Communication Systems
EE	4643	Digital Signal Processing
EE	4813	Electrical Engineering Design*

*May be used in satisfying the Core Curriculum requirements in Domain IV.

2. 9 semester hours of supporting courses:

EGR	2213	Engineering Mechanics
ME	3283	Fundamentals of Thermal Sciences
STA	3533	Probability and Random Processes

B. 9 hours of electrical engineering electives, to be selected from the following:

EE	4243	Digital Systems Design II
EE	4323	Advanced Electrical Engineering Laboratory
EE	4333	Instrumentation Systems

EE 4343 Active Filter Synthesis
EE 4353 Introduction to Modern Optics
EE 4443 Discrete-Time and Computer-Controlled Systems
EE 4453 Principles of Bioengineering and Bioinstrumentation
EE 4513 LSI and VLSI Design
EE 4523 Integrated Circuit Design
EE 4573 Engineering Workstations
EE 4583 Microcomputer Systems II
EE 4623 Digital Filtering
EE 4653 Information Theory and Coding
EGR 4723 Intelligent Robotics

COURSE DESCRIPTIONS
ELECTRICAL ENGINEERING
(EE)

2112 Introductory Digital Laboratory
(1-3) 2 hours credit. Prerequisite: Concurrent enrollment in EE 2513.
Introductory digital laboratory for computer science students enrolled in EE 2513. Not open to electrical engineering majors.

2213 Electric Circuits and Electronics
(3-0) 3 hours credit. Prerequisites: PHY 1924 and 1931, and completion of or concurrent enrollment in MAT 3253.
Electric, magnetic, and electronic circuits; transient analysis, transforms and phasors; transformers; solid state devices; analog and digital circuits. Not open to electrical engineering majors.

2423 Network Theory
(3-0) 3 hours credit. Prerequisites: MAT 2213, and completion of or concurrent enrollment in PHY 1924 and MAT 3253.
Basic network principles; steady state responses to DC and AC signals; transient responses; nodal and loop analysis; Laplace transforms; and 2-port analysis. Use of SPICE to solve network problems. (Formerly EE 2424. Credit cannot be earned for both EE 2423 and EE 2424.)

2513 Logic Design
(3-0) 3 hours credit. Prerequisite: Computer science major, or completion of or concurrent enrollment in CS 2073.
Number systems, Boolean Algebra, combinational and sequential circuit design. Minimization and implementation. Introduction to computer-aided design (CAD) tools. (Formerly EE 2514. Credit cannot be earned for both EE 2513 and EE 2514.)

3113 Electrical Engineering Laboratory I
(1-6) 3 hours credit. Prerequisites: EE 2423, 2513, and completion of or concurrent enrollment in EE 3313.
Introduction to basic measurement equipment and techniques. Use of analog and digital simulation tools; comparison to empirical performance of simple analog communication and digital circuits using discrete devices and circuits. Simple subsystem circuit design. Laboratory technical communication.

3213 Electromagnetic Engineering
(3-0) 3 hours credit. Prerequisites: PHY 1924, MAT 2213, and MAT 3253.
Review of vector calculus, Maxwell's equations, electromagnetic waves, dielectrics, and boundary conditions. Selected other topics include waveguides, anistropic crystal optics, transmission lines, fiber optics, reflection and refraction, and special relativity.

3313 Electronic Circuits I
(3-0) 3 hours credit. Prerequisites: PHY 1924, CHE 1303, EE 2423, and completion of or concurrent enrollment in EE 3423 or ME 3323.
Electrical properties of semiconductors; P-N junctions; diode circuits; BJT's and FET's; and application to digital and analog circuits. Use of SPICE to solve simple circuits.

3413 Analysis and Design of Control Systems
(3-0) 3 hours credit. Prerequisites: EGR 2213 and EE 3423 for electrical engineering major; ME 3323 for mechanical engineering major.
Modeling, analysis, and design of linear automatic control systems. Time and frequency domain techniques; stability analysis, state variable techniques, and other topics. (Formerly EE 4413. Credit cannot be earned for both EE 3413 and EE 4413.)

3423 Network Analysis
(3-0) 3 hours credit. Prerequisites: EE 2423 and MAT 3253.
Frequency response and complex variables, Fourier series, Fourier transforms, Dirac Delta function, convolution, mathematical modeling of systems, and the Z-transform.

3463 Microcomputer Systems I
(3-0) 3 hours credit. Prerequisites: EE 2513, and completion of or concurrent enrollment in EE 3563.
Introduction to assembly- and C-language programming. Architecture, peripherals, operating system interfacing principles, and development tools. Software documentation techniques. (Formerly EE 4563. Credit cannot be earned for both EE 3463 and EE 4563.)

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

3563 Digital Systems Design I
(2-3) 3 hours credit. Prerequisite: EE 2513.
Introduction to switching theory. Design of complex combinational and sequential circuits. Analysis of hazards and fault detection, location, and tolerance. Design and verification of complex circuitry using Design Entry, functional modeling, physical modeling, and mixed-mode simulation.

4113 Electrical Engineering Laboratory II
(1-6) 3 hours credit. Prerequisites: EE 3113, 3463, and 4313.
Complex electronic circuit subsystem design. Improving measurement system performance. Introduction to automatic test equipment, the design process, and simple system design. Technical communication.

4243 Digital Systems Design II
(2-3) 3 hours credit. Prerequisites: EE 3463 and 3563.
Design of advanced state machines and computer systems. Processor design. Simulation and other computer-assisted design tools. (Formerly EE 3583. Credit cannot be earned for both EE 4243 and EE 3583.)

4313 Electronic Circuits II
(3-0) 3 hours credit. Prerequisites: EE 3313, 3423, and 3563.
Multiple transistor circuits; feedback and frequency response analysis; operational amplifier analysis and design; power semiconductors; and other topics. Design of analog and digital circuits. Use of SPICE to analyze complex circuits.

4323 Advanced Electrical Engineering Laboratory
(1-6) 3 hours credit. Prerequisites: Completion of or concurrent enrollment in EE 4113 and consent of instructor.
Laboratory experience in one of the following areas: controls, optics, digital systems, communications, or instrumentation.

4333 Instrumentation Systems
(2-3) 3 hours credit. Prerequisites: EE 3463, 3413, and completion of or concurrent enrollment in EE 4113.
Principles of instrumentation system design, transducers, power supplies, and signal conditioning. Noise analysis and reduction techniques. Standard protocol instrumentation buses.

4343 Active Filter Synthesis
(2-3) 3 hours credit. Prerequisite: EE 4313.
Analysis and design of active filter networks. Sensitivity analysis and filter design techniques. Passive synthesis, switched capacitor filters, and other topics.

4353 Introduction to Modern Optics
(3-0) 3 hours credit. Prerequisite: EE 3213.
The basic principles of geometrical and physical optics. Topics include lens design, interference, diffraction, and polarization. Selected other topics which may be covered include Fourier optics, coherence theory, holography, lasers, Gaussian beams, acousto-optics, and electro-optics.

4443 Discrete-Time and Computer-Controlled Systems
(2-3) 3 hours credit. Prerequisites: EE 3413 and completion of or concurrent enrollment in EE 4643.
Sampled-data techniques applied to the analysis and design of digital control systems. Stability criteria, compensation, and other topics.

4453 Principles of Bioengineering and Bioinstrumentation
(2-3) 3 hours credit. Prerequisites: EE 3213, 3413, and completion of or concurrent enrollment in EE 4113.
Theoretical basis for signal generation, transmission, and detection from biological systems. Modeling of biological systems. Electrodes and transducer systems; signal excitation and processing instrumentation.

4513 LSI and VLSI Design
(2-3) 3 hours credit. Prerequisites: EE 3213, 4313, and completion of or concurrent enrollment in EE 4243 or 4583.
Design of integrated digital systems. Logic simulation, standard cell libraries, circuit simulation, and other computer-aided design tools. Integrated circuit processing and device modeling.

4523 Integrated Circuit Design
(2-3) 3 hours credit. Prerequisites: EE 3213 and 4313.
Analysis and design of analog and digital integrated circuits. Integrated circuit technologies, computer-aided analysis, design, and other tools. Fabrication and testing.

4573 Engineering Workstations
(2-3) 3 hours credit. Prerequisites: EE 3463 and 3563.
Design and application of engineering workstations. Integration of components and peripherals to address specific engineering design support requirements. Networking considerations.

4583 Microcomputer Systems II
(2-3) 3 hours credit. Prerequisite: EE 3463, 3313, and completion of or concurrent enrollment in EE 4313.
Advanced microprocessor-based system design. High-speed bus interfacing, coprocessors, and other specialized input/output devices. Real-time and multi-user operating systems. High-level languages and software performance analysis.

4613 Communication Systems
(3-0) 3 hours credit. Prerequisites: STA 3533 and completion of or concurrent enrollment in EE 4313.
Fundamentals of communication systems engineering, using analog and digital techniques. Signal analysis, signal-to-noise ratio, and circuit implementations.

4623 Digital Filtering
(2-3) 3 hours credit. Prerequisites: EE 3463 and 4643.
Design and implementation of FIR and IIR filters, hardware, and software. Topics from adaptive filtering, neural networks, and image processing.

4643 Digital Signal Processing
(3-0) 3 hours credit. Prerequisites: EE 3423 and STA 3533.
Transform techniques for discrete signal analysis. Discrete representation and analysis of digital filters and other topics.

4653 Information Theory and Coding
(3-0) 3 hours credit. Prerequisite: STA 3533.
Elements of information theory and modulation and coding for efficient signaling and error correction. Hardware and software implementation of encoders and decoders.

4813 Electrical Engineering Design
(1-6) 3 hours credit. Prerequisites: EE 4113, 4643, and EGR 3713.
Complex system design. Advanced ATE. Project management, proposals, status reporting, formal oral and written technical reports, and business plan. Open-ended design project. Considers safety, reliability, environmental, economic, and other constraints. Ethical and social impacts.

4911-3 Independent Study
1-3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.
Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to a bachelor's degree.

4953 Special Studies in Electrical Engineering
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

BACHELOR OF SCIENCE DEGREE IN MECHANICAL ENGINEERING

The B.S. degree program in Mechanical Engineering offers students the opportunity to prepare for careers in traditional as well as emerging high-technology areas of engineering design associated with machinery and mechanism design, thermal and fluid sciences, solid mechanics of advanced metallic or polymer-based composite materials, computer-aided design (CAD), vibrations and controls, robotics, and bioengineering. Through the proper selection of elective courses to augment required courses, successful students may develop a specialization pertinent to many of these areas, which may lead to employment with companies or government agencies associated with aerospace, automotive, heating and air conditioning, manufacturing, and other industries.

A. 51 semester hours of required courses:

EE	2213	Electric Circuits and Electronics
EGR	2203	Statics
EGR	2503	Dynamics
EGR	3213	Mechanics of Solids
ME	3201	Network and Electronics Laboratory
ME	3241	Materials Engineering Laboratory
ME	3243	Materials Engineering
ME	3293	Thermodynamics I

ME 3313 Measurements and Instrumentation
ME 3323 Dynamics of Mechanical Systems
ME 3423 Applied Engineering Analysis
ME 3513 Mechanism Design
ME 3523 Machine Element Design
ME 3663 Fluid Mechanics
ME 4293 Thermodynamics II
ME 4313 Heat Transfer and Rate Processes
ME 4522 Dynamic Systems Control
ME 4802 Mechanical Engineering Senior Laboratory
ME 4813 ME Design Project*

*May be used in satisfying the Core Curriculum requirements in Domain IV.

B. 12 semester hours of engineering electives:

1. 9 semester hours of mechanical engineering, 6 of which must be selected from the following:

ME 4323 Thermal Systems Design I
ME 4333 Thermal Systems Design II
ME 4343 Heating, Air Conditioning, and Refrigeration Design
ME 4413 Intermediate Mechanism Design
ME 4423 Intermediate Machine Element Design
ME 4513 Mechanical Vibrations and Dynamics of Machinery
ME 4533 Mechanical Engineering Design Methodology
ME 4603 CAD Methodology
ME 4613 Power Systems Design
ME 4723 Reliability and Quality Control in Engineering Design

2. 3 semester hours of engineering electives.

COURSE DESCRIPTIONS
MECHANICAL ENGINEERING
(ME)

3201 Network and Electronics Laboratory
(0-3) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in EE 2213.
Basic experiments with electrical networks and electronic circuits. (Formerly EE 3401. Credit cannot be earned for both ME 3201 and EE 3401.)

3241 Materials Engineering Laboratory
(0-3) 1 hour credit. Prerequisite: Completion of or concurrent enrollment in ME 3243.
Investigation of the properties of engineering materials, with emphasis on metals, sample preparation, metallography, and foundry processes.

3243 Materials Engineering
(3-0) 3 hours credit. Prerequisites: CHE 1303 and completion of or concurrent enrollment in EGR 3213.
Fundamental aspects of the structure, properties, and behavior of engineering materials.

3263 Materials Processing
(2-3) 3 hours credit. Prerequisites: ME 3243 and EGR 2503.
Casting, joining, forming, and machining. Methods of processing modern engineering materials, forming and joining techniques, and effects of processing on materials.

3283 Fundamentals of Thermal Sciences
(3-0) 3 hours credit. Prerequisites: CS 2073, PHY 1904, and completion of or concurrent enrollment in MAT 3253.
Introduction to classical thermodynamics, fluid mechanics, and heat transfer; thermodynamics systems, first and second laws cycles; fluid statics and dynamics; applications of conduction, convections, and radiation heat transfer. Not open to students majoring in Mechanical Engineering. May not be substituted for ME 3293 or ME 4313.

3293 Thermodynamics I
(3-0) 3 hours credit. Prerequisites: CS 2073, PHY 1904, and MAT 2213.
Heat, work, kinetic theory of gases, equation of state, thermodynamics system, control volume, first and second law of thermodynamics, reversible and irreversible processes, and introduction to basic thermodynamic cycles.

3313 Measurements and Instrumentation
(2-3) 3 hours credit. Prerequisites: CS 2073, EGR 3213, MAT 3253, and ME 3201.
Fundamentals of measurement systems; standards and treatment of data; transducers and signal conditioning; strain, force, acceleration, pressure, temperature, and fluid flow.

3323 Dynamics of Mechanical Systems
(2-2) 3 hours credit. Prerequisites: EGR 2213 or 2503, and MAT 3253.
Mechanical system dynamics, linear systems, modeling techniques, analytical dynamics, and vibrations.

3423 Applied Engineering Analysis
(3-0) 3 hours credit. Prerequisites: CS 2073 and MAT 3253.
Application of mathematical principles to the analysis of engineering problems, using traditional and modern techniques.

3503 Alternative Energy Sources
(3-0) 3 hours credit. Prerequisite: ME 3293.
Solar, nuclear, wind, geothermal, and tidal energy. Energy storage problems. Principles, current technology, and economic considerations.

3513 Mechanism Design
(3-0) 3 hours credit. Prerequisites: CS 2073 and EGR 2503.
Introduction to kinematics and mechanisms, and graphical and linear analytical methods for kinematic synthesis; displacement, velocity, and acceleration analyses of mechanisms; and cam design.

3523 Machine Element Design
(3-0) 3 hours credit. Prerequisites: EGR 3213, ME 3243, and completion of or concurrent enrollment in ME 3513.
Stress and deflection analyses, failure theories, design of machine elements for static and fatigue strength, mechanical springs, and design of welded and bolted connections.

3663 Fluid Mechanics
(3-0) 3 hours credit. Prerequisites: CS 2073, MAT 2213, and EGR 2503.
Fluid properties; fluid statics; concepts and equations of fluid flow; similitude; viscous effects; and compressible fluid flow.

4243 Intermediate Materials Engineering
(3-0) 3 hours credit. Prerequisites: ME 3243, 3241, and 3523.
Selected topics in ceramics and polymers; introduction to composites; fracture mechanics and corrosion; engineering design applications in material selection for control of fracture, deflection, wear, and corrosion.

4263 Nondestructive Evaluation
(2-3) 3 hours credit. Prerequisites: ME 3243 and 3313.
Defect detection. Materials and defect characterization using nondestructive evaluation methods such as ultrasonics, eddy current, magnetic and electromagnetic methods, radiography, and thermography.

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

4313 Heat Transfer and Rate Processes
(3-0) 3 hours credit. Prerequisites: ME 3293, 3423, and completion of or concurrent enrollment in ME 3663.
Generalized potential distribution and gradients; transient and steady heat conduction; forced and free convection; and radiation, energy, and momentum transfers.

4323 Thermal Systems Design I
(2-2) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in ME 4313.
Application of basic thermodynamics, fluid mechanics, heat transfer and computer methods to the design of heat exchanger systems.

4333 Thermal Systems Design II
(2-2) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in ME 4313.
Design of thermal energy systems; coils, fans, pumps, and filter systems; and automatic control systems.

4343 Heating, Air Conditioning, and Refrigeration Design
(2-2) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in ME 4293 and 4313.
Heating, ventilation, and air conditioning of buildings for human comfort or industrial processes; design selection, construction, and operation of air conditioning equipment and refrigeration systems.

4353 Gas Dynamics
(3-0) 3 hours credit. Prerequisites: ME 3293 and 3663.
Application of mass, energy, and force balance to compressible fluids; treatment of one-dimensional steady and transient flows, isentropic flow, adiabatic flow, and flow with friction. Application to duct flows and to jet and rocket propulsion engines.

4363 Intermediate Heat Transfer
(3-0) 3 hours credit. Prerequisite: ME 4313.
Multidimensional heat conduction, numerical solutions, selected topics in natural convection, boiling and condensation heat transfer, and thermal storage systems.

4413 Intermediate Mechanism Design
(3-0) 3 hours credit. Prerequisite: ME 3513.
Linear and nonlinear analytical methods for kinematic synthesis; statics, kinetostatics, and dynamics of mechanisms; design of cam and cam-link mechanisms; case studies; and computer-aided design.

4423 Intermediate Machine Element Design
(3-0) 3 hours credit. Prerequisite: ME 3523.
Design of spur, helical, bevel, and worm gearings; design of couplings, clutches, and brakes; design of journal and rolling bearings, belts and chains; and computer-aided design.

4503 Intermediate Dynamics
(3-0) 3 hours credit. Prerequisite: ME 3323.
Three-dimensional rigid-body kinetics, vector algebraic and Lagrange methods; integration of equations of motion; and computer-assisted methods.

4513 Mechanical Vibrations and Dynamics of Machinery
(2-2) 3 hours credit. Prerequisites: ME 3323 and 3423.
Free and forced single and multiple degree of freedom systems, modeled as both discrete and continuous. Applications in mechanical engineering design problems in the transmission and control of vibration.

4522 Dynamic Systems Control
(1-4) 2 hours credit. Prerequisites: ME 3313, 3323, and 3423.
Introduction to modeling and control of dynamic physical systems; analysis and design of control systems for mechanical, electrical, fluid, and thermal systems. (Formerly ME 3353. Credit cannot be earned for both ME 4522 and ME 3353.)

4533 Mechanical Engineering Design Methodology
(3-0) 3 hours credit. Prerequisites: ME 3323, 3523, 3663, and completion of or concurrent enrollment in ME 4313.
Mechanical systems component design methodology; creative design, analysis, synthesis, selection, and design of components and systems; computer-aided design; and several short design projects. (Formerly ME 3533. Credit cannot be earned for both ME 4533 and ME 3533.)

4603 CAD Methodology
(2-3) 3 hours credit. Prerequisite: ME 3523.
Advanced geometric modeling of mechanical systems and components, design case studies, and finite element applications in mechanical design.

4613 Power Systems Design
(2-2) 3 hours credit. Prerequisite: ME 4293.
Application of basic fluid mechanics to the design of turbomachinery, turbines, pumps, compressors, fans, blowers, windmills, and combustion engines.

4663 Intermediate Fluid Mechanics
(3-0) 3 hours credit. Prerequisite: ME 3663.
Continuation of ME 3663. Potential flow theory, analysis of laminar and turbulent flows, introduction to boundary layer theory, and application of basic equations to engineering problems.

4703 Computer Applications in Mechanical Engineering
(2-3) 3 hours credit. Prerequisites: ME 3523, 4293, and completion of or concurrent enrollment in 4313.
Application of computers in mechanical and thermal design and software package development. Program development includes fluid flow and mechanical property characterization and heat transfer determination.

4723 Reliability and Quality Control in Engineering Design
(3-0) 3 hours credit. Prerequisite: Senior standing in the Division of Engineering.
Introduction to statistical methods in reliability and probabilistic engineering design methodology; statistical quality control and inspection; life prediction and testing, and design optimization.

4802 Mechanical Engineering Senior Laboratory
(0-6) 2 hours credit. Prerequisites: ME 3313, 3523, 4293, and completion of or concurrent enrollment in ME 4313.
An experimental laboratory concerned with fluid statics, fluid flow, heat transfer, internal combustion engines, rotating machinery, and design of experiments.

4813 ME Design Project
(2-3) 3 hours credit. Prerequisites: EGR 3713, ME 3523, ME 4293, and ME 4313.
Significant development of instructor-approved individual and/or group design project. Synthesis, modeling, computer-aided analysis, and optimization of an open-ended problem. Industrial cooperation encouraged. Formal presentation of progress and final reports. Considers safety,

reliability, environmental, economic, and other constraints. Ethical and social impacts.

4911-3 Independent Study
1-3 hours credit. Prerequisite: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.
Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours of independent study, regardless of discipline, will apply to a bachelor's degree.

4953 Special Studies in Mechanical Engineering
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

DIVISION OF LIFE SCIENCES

The Division offers a Bachelor of Science degree in Biology, with emphases in Molecular Cell Biology and Neurobiology. 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.

DIVISIONAL HONORS

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

Selection of students for admission to the Division Honors Program is based on the student's academic performance and recommendation by the faculty. To be eligible for the program, students must have a minimum grade-point average of 3.0 overall and a minimum grade-point average of 3.5 in their major. The minimum grade-point averages must be maintained for students to receive the approval of the Division Honors Committee and faculty. Students admitted to the Division Honors program are expected to enroll in Honors Thesis (BIO 4993) during the final two semesters in residence. The completed thesis must be approved by the supervising faculty sponsor and another Divisional faculty member. Students interested in this program should contact their faculty advisors for additional information. Division Honors can be attained independent of University Honors or in addition to University Honors.

JOINT ALLIED HEALTH SCIENCE PROGRAMS

Joint degree programs with The University of Texas Health Science Center at San Antonio (UTHSCSA) leading to the Bachelor of Science degree are available in Clinical Laboratory Sciences, Occupational Therapy, and Physical Therapy. Degrees in these three Allied Health programs are awarded jointly.

The preclinical curriculum for Clinical Laboratory Sciences (CLS) includes Core Curriculum requirements, basic science lecture and laboratory courses, and CLS courses. CLS concepts are introduced throughout the curriculum, ending in a senior-year clinical practicum at the Health Science Center. Upon completion of all requirements, the student is eligible to take one of the CLS national certification examinations.

The preprofessional curriculum 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 fieldwork experience. Students who have completed all degree requirements and fieldwork are eligible to take the national examination for registration with the American Occupational Therapy Association.

The preprofessional curriculum in Physical Therapy offers the opportunity for students to use the basic sciences necessary to evaluate and treat human movement disorders. Clinical observation and fieldwork 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 graduates are eligible to take the Physical Therapy licensure examination following successful completion of this joint degree program.

PREPROFESSIONAL CURRICULUM

Also available are preprofessional courses which offer the students the opportunity to prepare for admission to nursing, medical, dental, and other professional schools.

UTSA offers courses which fulfill the nursing preprofessional curriculum requirements for The University of Texas Health Science Center at San Antonio. All coursework listed will transfer to UTHSCSA without any loss of credit. Specific premedical and predental programs are not offered at UT San Antonio. Admission requirements for these professional schools are outlined in a separate section 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 Subcommittee of The University of Texas at San Antonio.

PROFESSIONAL LIABILITY (MALPRACTICE) INSURANCE REQUIREMENT

Allied health students are required by policies of the Board of Regents of The University of Texas System to show evidence of professional liability (malpractice) insurance coverage PRIOR to official registration for courses that involve a clinical situation. Additional information on the requirement or obtaining such coverage is available from the Director of the Division of Life Sciences.

BACHELOR OF SCIENCE DEGREE IN BIOLOGY

The minimum number of semester hours required for the Bachelor of Science degree in Biology, including the Core Curriculum requirements, is 126. All major and support work courses must be completed with a grade of C or better.[1]

All candidates for the degree must complete the following:

A. 48 semester hours in the major, 32 of which must be at the upper-division level:

   1. 23 semester hours in biology are required:

      BIO 1203 Biology I
      BIO 1212 Laboratory Investigations in Biology

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[1] Students seeking teacher certification should consult the Certification Program through the Office of Teacher Advising, Certification, and Placement in the Division of Education for information. Undergraduates seeking elementary teacher certification must complete the Interdisciplinary Studies degree.

BIO 1212 Laboratory Investigations in Biology
BIO 1223 Biology II
BIO 2313, 2322 Genetics and Laboratory
BIO 3413, 3422 General Physiology and Laboratory
BIO 3513, 3522 Biochemistry and Laboratory

2. 10 semester hours of upper-division biology electives. Two of the following must be completed:

BIO 3143, 3152 Developmental Biology and Laboratory
BIO 3283, 3292 Principles of Ecology and Laboratory
BIO 3713, 3722 Microbiology and Laboratory

BIO 3813, 3822 Cellular Biology and Laboratory
BIO 4433, 4442 Neurobiology and Laboratory

3. 15 additional semester hours of biology electives, 12 of which must be at the upper-division level.

B. 24-25 semester hours of support work:

1. 13 semester hours are required in chemistry:

CHE 1103 Introductory Chemistry
CHE 1303 Chemical Principles
CHE 1312 Inorganic Qualitative and Quantitative Analysis
CHE 2203, 2242 Organic Chemistry I and Laboratory

2. A minimum of 3 semester hours of mathematics, to be selected from the following:

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

3. 8 semester hours of physics:

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

C. 12 semester hours of free electives.

UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE IN CLINICAL LABORATORY SCIENCES (CLS)

Certain specific physical skills and abilities are required to successfully participate in the CLS 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, clinical laboratory sciences courses are offered throughout the course of study, culminating in a concentrated clinical hospital experience at The University of Texas Health Science Center at San Antonio. Students complete clinical laboratory sciences courses during their sophomore and junior years, and will enroll in classes on both the UTSA and UTHSC campuses.

To enroll in UTHSC courses, students must complete a course card obtainable from both the UTHSC Admissions and Registrar and the Department of Clinical Laboratory Sciences. All CLSC courses are taught at the Health Science Center and are listed separately.

For consideration for admission into the joint degree program, the student must complete a separate application form. This form may be obtained from the Registrar's Office at The University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Drive, San Antonio, Texas 78284. This application should be submitted by May 1 for fall admission and November 1 for spring admission. Students must be admitted to UTHSCSA before they enroll in CLSC courses. Minimum requirements for admission to UTHSCSA include 24 hours of college work, an overall GPA of 2.0, and no grade lower than "C" in any basic science course.

Admission to and successful continuation in the program will provide the student with a clinical practicum position at one of the Health Science Center teaching affiliates. A list of these affiliates may be obtained from the Department of Clinical Laboratory Sciences at UTHSCSA.

The Clinical Laboratory Sciences Program is accredited by the Committee on Allied Health Education and Accreditation in cooperation with the National Accrediting Agency for Clinical Laboratory Sciences. Upon successful completion of this joint degree program, the student is eligible to take one of the national certification examinations. All students are encouraged to be counseled each semester by either the CLS Department Chair or a member of the CLS faculty to ensure enrollment in appropriate coursework.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 155.

All candidates for the degree must complete:

A. 57 semester hours in preprofessional support work:

1. 27 semester hours in the biological sciences:

AHS	1883	Introduction to Clinical Laboratory Sciences
BIO	1203	Biology I
BIO	1212	Laboratory Investigations in Biology
BIO	2313	Genetics
AHS	2103	Human Biology: Physiology
		or
	AHS 3413	General Physiology
		or
	AHS 3463	Human Physiology
BIO	3513, 3522	Biochemistry and Laboratory
BIO	3713, 3722	Microbiology and Laboratory
BIO	4743	Immunology

2. 13 semester hours in chemistry:

CHE	1103	Introductory Chemistry
CHE	1303	Chemical Principles

CHE 1312 Inorganic Qualitative and Quantitative Analysis
CHE 2203, 2242 Organic Chemistry I and Laboratory

3. 8 semester hours in physics:

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

4. 6 semester hours in mathematics:

MAT 1093 Precalculus
STA 1053 Basic Statistics

5. 3 semester hours in computer sciences.

B. 59 semester hours in clinical laboratory sciences, all of which must be completed at UTHSC:

1. These courses are taken prior to clinical training and are integrated with support work taken at UTSA:

CLSC 20351, 20252 Hematology and Laboratory
CLSC 20301, 20202 Parasitology and Urinalysis and Laboratory
CLSC 30361, 30262 Immunochematology and Serology and Laboratory
CLSC 30381, 30282 Clinical Chemistry and Laboratory
CLSC 30333, 30234 Medical Microbiology and Laboratory

2. These courses are the senior lecture and clinical experience courses:

a. Senior Fall
CLSC 40333 Advanced Medical Microbiology
CLSC 40353 Advanced Hematology
CLSC 40587 Chemistry Practicum
CLSC 40567 Immunohematology Practicum
CLSC 40192 Management I

b. Senior Spring
CLSC 40383 Advanced Clinical Chemistry
CLSC 40255 Advanced Immunohematology
CLSC 40557 Hematology Practicum
CLSC 40537 Microbiology Practicum
CLSC 40293 Management II

POST-BACCALAUREATE CLINICAL LABORATORY SCIENCES CERTIFICATE OPTION

A post-baccalaureate certificate option in Clinical Laboratory Sciences is available. It is designed for students who hold a bachelor's degree in science from an accredited institution. The curriculum includes 59 hours of professional coursework. Prerequisite science requirements not completed as a part of the bachelor's degree may be taken as a part of the certificate curriculum. The certificate option course of study is 18 months long.

In addition, the program offers a categorical certificate designed for individuals with a bachelor's degree in science who are interested in a particular sub-discipline of the clinical laboratory. These certificates are available in Microbiology, Clinical Chemistry, Immunochematology, and Hematology. Students can complete the categorized requirements in 12-18 months, based on part-time enrollment. Successful completion of the certificate curriculum qualifies students to take the national certification examinations as generalists or categorical scientists.

Interested persons should contact the Department of Clinical Laboratory Sciences at UTHSCSA for further details.

UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE IN OCCUPATIONAL THERAPY

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

Admission to the program is made through The University of Texas Health Science Center at San Antonio. Students should seek admission to the professional program only after completing all coursework necessary to meet Core Curriculum as well as preprofessional (support work) requirements for the program. These may be completed at UTSA or another accredited college or university. However, non-UTSA students must be accepted for admission to The University of Texas at San Antonio prior to application to the professional program. Admission to UTSA does not assure admission to the Occupational Therapy program. However, all students are encouraged to be counseled by a member of the occupational therapy faculty at UTHSC or by the UTSA Division of Life Sciences Undergraduate Advisor to ensure enrollment in appropriate preprofessional coursework.

Professional coursework begins in early June of each year and classes are conducted at The University of Texas Health Science Center campus. The professional program involves assignment to facilities in San Antonio and other cities for completion of supervised clinical rotations.

Application for admission to the professional phase of the program must be made by February 1 of the year for which admission is sought. The application process is initiated by contacting:

Allied Health Admissions
The University of Texas Health Science Center at San Antonio
7703 Floyd Curl Drive
San Antonio, Texas 78284
210-567-3111

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

Students who select the joint degree option should make sure that they have completed *both* the Core Curriculum requirements and all but 6 hours of non-

science, preprofessional support work requirements prior to June of the year of admission to the professional phase of the Occupational Therapy program. It is the responsibility of the applicant to arrange to have transcripts forwarded to the UTHSC Office of Admissions prior to February 1 of the year for which application is being made.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 175.

All candidates for the degree must complete:

A. 37-39 semester hours of preprofessional support work:

1. 9-10 semester hours in the biological sciences:

BIO 1203, 1212 Biology I and Laboratory
AHS 2083, 2091 Human Biology: Anatomy and Laboratory
or
BIO 2123, 2132 Comparative Anatomy of Vertebrates and Laboratory

2. 4-5 semester hours in chemistry:

CHE 1003, 1011 General Chemistry for Allied Health Sciences
or
CHE 1103, 1122 Introductory Chemistry and Laboratory and Laboratory Workshop

3. 6 semester hours in mathematics and statistics:

MAT 1063 College Algebra
STA 1053 Basic Statistics

4. 3 semester hours in physics:

PHY 1603 General Physics I
PHY 1611 General Physics I Laboratory (optional)

5. 3 semester hours in computer sciences.

6. 9 semester hours in psychology:

PSY 2013 Fundamentals of Psychology
PSY 2503 Developmental Psychology (Life Span)
PSY 2513 Abnormal Psychology

7. 3 semester hours in sociology or anthropology.

B. 70 semester hours in the major at the upper-division level. These courses must be completed at The University of Texas Health Science Center at San Antonio:

JUNIOR SUMMER:

CSBL	30616	Gross Anatomy	6 hours
PHYL	30412	Human Physiology	4 hours
OCCT	30105	Medical Terminology	1 hour

JUNIOR FALL:

OCCT	30216	Foundations in OT	2 hours
OCCT	30204	Assistive Technology in OT	2 hours
OCCT	30401	Health and Occupation	4 hours
OCCT	30410	Human Neurosciences in OT	4 hours
OCCT	30420	Biomechanical Approach in OT	4 hours

JUNIOR SPRING:

MEDI	30414	Clinical Medicine	4 hours
OCCT	30325	Design & Fabrication	3 hours
OCCT	30331	OT in Physical Dysfunction	3 hours
PATH	30311	Pathology	3 hours
OCCT	30171	Practicum/Physical Dysfunction	1 hour
OCCT	30391	Skills Lab/Physical Dysfunction	3 hours

SENIOR FALL:

OCCT	40333	OT in Development Dysfunction	3 hours
OCCT	40382	Management and Consultation	3 hours
OCCT	40173	Practicum/Developmental Dysfunction	1 hour
OCCT	40393	Skills Lab/Developmental Dysfunction	3 hours
OCCT	40351	Research in Occupational Therapy	3 hours

SENIOR SPRING:

MEDI	40212	Medical Management in Psychosocial	2 hours
OCCT	40332	OT in Psychosocial Dysfunction	3 hours
OCCT	40172	Practicum/Psychosocial Dysfunction	1 hour
OCCT	40326	Clinical Reasoning in OT	3 hours
OCCT	40392	Skills Lab/Psychosocial Dysfunction	3 hours
OCCT	40127	Geriatric Issues in OT	1 hour

C. 36 semester hours of fieldwork, to be completed at selected clinical sites affiliated with The University of Texas Health Science Center at San Antonio (an additional fieldwork placement course, OCCT 40876, is optional):

OCCT	41271	Fieldwork/Physical Dysfunction	12 hours
OCCT	41272	Fieldwork/Psychosocial Dysfunction	12 hours
OCCT	41273	Fieldwork/Specialty Area	12 hours

UTSA/UTHSC JOINT BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY

The program in Physical Therapy has a joint degree option which is fully accredited by the Committee on Accreditation of the American Physical Therapy Association. Upon completion of this four-year program, students are eligible to take the licensure examination offered by the Professional Examination Service, which is required for practice in Texas. For practice in other states, the appropriate State Licensing Board must be contacted.

The professional phase of this program is taken at The University of Texas Health Science Center at San Antonio, and begins in the summer of the student's junior year.

Application to the program must be made by October 1 prior to the summer in which the student wishes to be admitted. This application process is initiated by writing to:

Allied Health Admissions
The University of Texas Health Science Center at San Antonio
7703 Floyd Curl Drive
San Antonio, Texas 78284
210-567-3150

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

Each student who selects the joint degree option is expected to complete all Core Curriculum requirements for grad-uation from UTSA, as well as program prerequisites for Physical Therapy, by August of the year prior to admission to the professional phase of the Physical Therapy program. The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 161.

All candidates for the degree must complete the following major and support work:

A. 38-40 semester hours of support work:

1. 8-10 semester hours of biological sciences:

AHS 2083, 2091 Human Biology: Anatomy and Laboratory
or
BIO 2123, 2132 Comparative Anatomy of Vertebrates and Laboratory
And
AHS 2103, 2111 Human Biology: Physiology and Laboratory
or
BIO 3413, 3422 General Physiology and Laboratory

2. 8-10 semester hours of chemistry with labs:

   CHE 1003, 1011 General Chemistry for AHS and Laboratory
   or
   CHE 1103, 1122 Introduction to Chemistry and Laboratory
   And
   CHE 1203, 1211 Elementary Organic and Biochemistry and Laboratory
   or
   CHE 1303, 1312 Chemical Principles and Inorganic Qualitative and Quantitative Analysis

3. 8 semester hours of physics with labs:

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

4. 6 semester hours of mathematics:

   MAT 1063 College Algebra (or higher)
   STA 1053 Basic Statistics (or 1063, 1073)

5. 6 semester hours of behavioral/social sciences:

   PSY 2013 Fundamentals of Psychology
   SOC 1013 Introduction to Sociology

B. 66-68 semester hours in the major at the upper-division level. These courses must be completed at The University of Texas Health Science Center:

JUNIOR SUMMER:

CSBL	30616	Gross Anatomy	6 hours
PHYT	30419	Ergonomics/Work Biology	4 hours
PHYT	30313	PT Patient Care & Application	3 hours

JUNIOR FALL:

INTD	30474	Kinesiology	4 hours
INTD	30345	Applied for PT Neuroscience	4 hours
PHYT	30321	Introduction to Therapeutic Exercise I & Application	3 hours
PHYT	30315	PT Evaluation & Documentation	3 hours
PHYT	30235	Physical Agents & Application for PT	2 hours
PHYT	30202	Junior Clinical I	2 hours

JUNIOR SPRING:

MEDI	30411	Clinical Medicine I	4 hours
PATH	30311	Pathology	3 hours
PHYT	30422	Clinical Orthopedics	4 hours
PHYT	30236	Clinical Electrotherapy & Application for PT	2 hours
PHYT	30208	Orthotics & Prosthetics for PT	2 hours
PHYT	30203	Junior Clinical II	2 hours

SENIOR SUMMER:

PHYT 40140	Gerontological Issues	1 hour
PHYT 40216	Cardiopulmonary PT	2 hours
PHYT 40226	Principles of Neurological Assessment	2 hours
PHYT 40292	Selected PT Topics	2 hours
PHYT 40294	Research Methodology	2 hours

SENIOR FALL:

PHYT 40093	Independent Studies	1-3 hours
PHYT 40227	Pediatric PT	2 hours
PHYT 40383	Administration of Management	3 hours
PHYT 40428	PT Management of the Adult Neurological Patient	4 hours

C. 22 semester hours of senior clinical coursework, to be completed at selected sites affiliated with UTHSCSA. Senior Clinical I is completed in the Senior Fall semester and Senior Clinical II in the Senior Spring:

PHYT 40671	Senior Clinical I	6 hours
PHYT 41672	Senior Clinical II	16 hours

UTHSCSA BACHELOR OF SCIENCE DEGREE IN NURSING

The UTHSCSA Nursing degree program is fully accredited by the National League for Nursing. The program is composed of two phases. In Phase I students complete a minimum of 60 hours (2 years) of prenursing course requirements, which are available at The University of Texas at San Antonio. Phase I coursework at UTSA is approved by the Division of Life Sciences Health Related Professions Advisory Subcommittee. Phase II requires students to complete 60 hours of courses in the nursing major through either the Generic Process or Flexible Process track at UTHSCSA School of Nursing. The minimum number of semester hours required for this degree is 120.

Admission into Phase I must be made through The University of Texas at San Antonio. Admission into Phase II must be made through The University of Texas Health Science Center at San Antonio. Students who have completed 40-45 hours of Phase I courses may request an Application for Admission from Nursing Admissions at UTHSCSA. Questions about Phase I Prenursing Course Requirements and requests for admissions applications should be addressed to:

Nursing Admissions
Office of Student Services
UTHSCSA
7703 Floyd Curl Drive
San Antonio, Texas 78284-7702
210-567-2670

Application for admission to Phase II must be made by April 1 for fall semester admission and October 1 for spring semester admission. Applicants must have an overall GPA of 2.0 and a GPA of 2.3 in prenursing course requirements in order

to be considered for admission. Students with higher GPAs will be more competitive.

Applicants must have passed all sections of the Texas Academic Skills Program (TASP) test and meet minimum standards before they may enroll in upper-division (Phase II) coursework. Students may not enroll in the upper-division nursing courses until they have completed the 60 hours of prerequisite courses and have been formally accepted by UTHSC.

Students admitted to the School of Nursing must be certified in cardiopulmonary resuscitation (CPR) prior to registration.

Phase I: 60 hours at UTSA. All courses are subject to approval by the School of Nursing when the student applies for Phase II.

A. 21-26 semester hours of natural and physical sciences:

AHS	2083, 2091	Human Biology: Anatomy and Laboratory*
AHS	2103, 2111	Human Biology: Physiology and Laboratory*
AHS	1053, 1061	Introductory Microbiology (Laboratory strongly recommended)*
CHE	1003, 1011	General Chemistry for Allied Health Sciences (Laboratory strongly recommended)
CHE	1203, 1211	Elementary Organic and Biochemistry (Laboratory strongly recommended)

*BIO 1203: Biology I and BIO 1212: Laboratory Investigations in Biology are prerequisites to the above AHS courses.

B. 15 semester hours in the behavioral sciences:

1. PSY 2013 Fundamentals of Psychology
   PSY 2503 Developmental Psychology
   SOC 1013 Introduction to the Study of Society

2. 6 semester hours of electives.

C. 24 semester hours in other basic requirements:

1. 6 required semester hours:

   AHS 2043 Nutrition
   STA 1053 Basic Statistics (or 1063 or 1073)

2. 18 semester hours of UTSA Core Curriculum requirements (for a listing of the courses which will fulfill these requirements, see the Bachelor's Degree Regulations chapter of this catalog).

   Rhetoric
   American History
   Political Studies

Phase II: One of the following plans, completed at UTHSC:

A. Generic Plan

The following lists the courses in the Generic Process Program Plan. This plan may be taken on a full-time or part-time basis but must be completed within four years of initial enrollment in Phase II of the nursing program.

FIRST SEMESTER, JUNIOR YEAR:

NURS 30209	Introduction to Professional Nursing	2 hours
NURS 30310	Nursing and Drug Therapy	3 hours
NURS 30911	Nursing of Individuals with Deviations in Health Status	9 hours

SECOND SEMESTER, JUNIOR YEAR:

NURS 30912	Nursing of Families: Childbirth, Parenting, Illness	9 hours
NURS 30522	Nursing the Client with Mental Illness	5 hours

THIRD SEMESTER, SENIOR YEAR:

NURS 40203	The Nurse as a Professional	2 hours
NURS 40523	Nursing of Clients with Chronic Health Problems	7 hours
NURS 40513	Community Health Nursing	5 hours

FOURTH SEMESTER, SENIOR YEAR:

NURS 40704	Nursing the Client with Major Health Problems	7 hours
NURS 40504	The Nurse as Manager and Leader	5 hours
Upper-Division Electives	Three hours of electives must be in nursing	9 hours

B. Flexible Plan

Only students with prior nursing experience are eligible for this plan. Although this program can be completed on a part-time basis, all work toward the degree must be completed within four years of the date of initial enrollment in Phase II of the nursing program. Some courses are offered by examination only. Credit for much of the program can be completed by examination also. For a complete list of those courses, contact The University of Texas Health Science Center School of Nursing.

FIRST SEMESTER:

NURS 30925	Nursing of Adults with Health Problems	9 hours
NURS 30926	Nursing of Children and Childbearing Women	9 hours
NURS 30327	Nursing of Clients with Alteration in Mental Health	3 hours
NURS 30624	Nursing Practice: Clinical Skills	6 hours

SECOND SEMESTER:

NURS 40212	Professional Nursing: Health Assessment	2 hours
NURS 40512	Professional Nursing: Health Promotion	5 hours
NURS 40504	The Nurse as a Manager and Leader	5 hours

THIRD SEMESTER:

NURS 40213	Professional Nursing: Issues and Ethics	2 hours
NURS 40413	Professional Nursing: Family Focus	4 hours
NURS 40513	Community Health Nursing	5 hours
Upper-Division Electives	Three semester hours of electives must be in nursing	9 hours

COURSE DESCRIPTIONS
ALLIED HEALTH SCIENCES
(AHS)

1053 Introductory Microbiology
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1212, or consent of instructor.
A general study of microorganisms, their characteristics, isolation, growth, and importance in nature, industry, public health, and human disease. (Credit cannot be earned for both AHS 1053 and BIO 3713.) [TCCN: BIOL 2320.]

1061 Introductory Microbiology Laboratory
(0-3) 1 hour credit.
Credit cannot be earned for both AHS 1061 and BIO 3722. [TCCN: BIOL 2120.]

1883 Introduction to Clinical Laboratory Sciences
(3-0) 3 hours credit. Prerequisite: CHE 1103 is recommended.
Overview of the profession of clinical laboratory sciences, including the clinical laboratory and its functions, relationship of physiological and pathological specimens to body systems, and medical terminology and medical laboratory calculations.

2043 Nutrition
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1212, or AHS 2103.
An examination of human nutritional needs from infancy to adulthood. [TCCN: BIOL 1322.]

2083 Human Biology: Anatomy
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1212.
Systemic anatomy of the human organism. Includes cell biology, histology, and gross anatomy of major organ systems. May not be applied to a B.S. in Biology. [TCCN: BIOL 2301.]

2091 Human Biology: Anatomy Laboratory
(3-0) 1 hour credit.
May not be applied to a B.S. in Biology. [TCCN: BIOL 2101.]

2103 Human Biology: Physiology
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1212.
Physiological processes in human systems. May not be applied to a B.S. in Biology. [TCCN: BIOL 2302.]

2111 Human Biology: Physiology Laboratory
(3-0) 1 hour credit.
May not be applied to a B.S. in Biology. [TCCN: BIOL 2102.]

3463 Human Physiology
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1212, CHE 1203 or 2203, or consent of instructor.
Physiological processes in human systems.

4783 Pathogenic Microorganisms
(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722.
A consideration of medically important microorganisms and their interaction with animal and human hosts.

4792 Pathogenic Microorganisms Laboratory
(0-6) 2 hours credit.

COURSE DESCRIPTIONS
BIOLOGY
(BIO)

1023 Human Sex and Reproduction
(3-0) 3 hours credit.
An in-depth look at human reproductive anatomy, physiology, and behavior. Topics to be considered include sexual selection, mating, endocrine function, fertilization, birth control, and sexually transmitted diseases. May apply toward the Level I Core Curriculum requirement in science. (Formerly BIO 2003. Credit cannot be earned for both BIO 1023 and BIO 2003.) [TCCN: BIOL 2303.]

1033 Drugs and Society
(3-0) 3 hours credit.
An examination of licit and illicit drugs and their biosocial effects. Topics include pharmacology of alcohol, stimulants, hallucinogens, addiction, and abuse. May apply toward the Level I Core Curriculum requirement in science. (Formerly BIO 3023. Credit cannot be earned for both BIO 1033 and BIO 3023.)

1203 Biology I
(3-0) 3 hours credit.
An introduction to the science of biology, emphasizing a comparative study of the diversity of life forms. Topics include cell biology, energetics, metabolism, sexual reproduction, development, physiology, and animal behavior. May apply toward the Level I Core Curriculum requirement in science. (Credit cannot be earned for both BIO 1203 and for either of the former courses BIO 1013 and BIO 1103.) [TCCN: BIOL 1306.]

1212 Laboratory Investigations in Biology
(0-6) 2 hours credit.
Introduction to the tools, techniques, and topics of modern experimental biology. May apply toward the Level I Core Curriculum requirement in science. (Formerly BIO 1112. Credit cannot be earned for both BIO 1212 and BIO 1112.) [TCCN: BIOL 1106.]

1223 Biology II
(3-0) 3 hours credit. Prerequisite: STA 1053 or an equivalent.
An introduction to the science of biology, emphasizing a comparative study of the diversity of life forms. Topics include the decomposers, the producers, the consumers, genetics, ecology, and evolution. May apply toward the Level II Core Curriculum requirement in science.

2123 Comparative Anatomy of Vertebrates
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1212.
A detailed study of anatomical differences and similarities of vertebrates with reference to evolutionary changes. Concurrent enrollment in BIO 2132 is recommended.

2132 Comparative Anatomy of Vertebrates Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 2123 is recommended.

2313 Genetics
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212, and CHE 1103 or an equivalent.
Principles governing transmission of hereditary factors in plants and animals, with emphasis on molecular biochemical and population genetics. Concurrent enrollment in BIO 2322 is recommended. [TCCN: BIOL 2316.]

2322 Genetics Laboratory
(0-6) 2 hours credit. Optional for non-majors.
Concurrent enrollment in BIO 2313 is recommended.

3003 Introduction to Oceanography
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212.
General oceanography, with emphasis on biological aspects and living marine resources.

3013 Introductory Pathology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212, or AHS 2103.
Concepts of disease and diagnosis of pathological conditions.

3033 Human Physiology and Performance
(3-0) 3 hours credit. Prerequisites: BIO 3413 or AHS 2103.
A systematic application of physiological principles to human equipment and space to improve adaptation and performance in the work environment.

3063 Invertebrate Biology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212.
A comprehensive study of the invertebrate animals, with emphasis on their taxonomy, morphology, ecology, and evolution.

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.

3103 Biotechnology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212.
An introduction to recent advances in biology related to biotechnology. Discussion of how advances might be used to promote basic research in medicine, agriculture, and other industries.

3143 Developmental Biology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212.
Sequential analysis of development in vertebrates and the factors which affect fertilization, organogenesis, and implantation. Concurrent enrollment in BIO 3152 is recommended.

3152 Developmental Biology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 3143 is recommended.

3163 Histology and Cytology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212.
The cytological and histological aspects of cellular organization. Concurrent enrollment in BIO 3172 is recommended.

3172 Histological and Cytological Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 3163 is recommended.

3213 Animal Behavior
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212.
A detailed study of animal behaviors and their biological determinants.

3273 Biology of Flowering Plants
(2-3) 3 hours credit.
A study of the wildflowers of Texas, emphasizing identification of the more common wildflowers, as well as family characteristics, flower anatomy, and plant morphology. Plant collecting techniques and wildflower photography will be included. Lecture, laboratory, and fieldwork will be included as part of the course.

3283 Principles of Ecology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, 1212, or consent of instructor; completion of the Core Curriculum requirement in mathematics.
A study of the interaction of organisms with their environment, with focus on ecological principles, adaptations of organisms, environmental

pollution, and principles of conservation. Concurrent enrollment in BIO 3292 is recommended for biology majors. May apply toward the Level II Core Curriculum requirement in science.

3292 Principles of Ecology Laboratory
(0-6) 2 hours credit.
A field-oriented course emphasizing modern ecological techniques, including examinations of plant and animal populations and measurement of selected chemical and physical parameters. Concurrent enrollment in BIO 3283 is recommended.

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 1203, 1223, and 1212.
A study of the life histories and phylogenetic relationships of vascular and non-vascular plants. Concurrent enrollment in BIO 3351 is recommended.

3351 Plant Sciences Laboratory
(0-3) 1 hour credit.
Concurrent enrollment in BIO 3343 is recommended.

3413 General Physiology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, 1212, CHE 1303, and PHY 1623. MAT 1093 is also recommended.
Fundamental properties and processes in living systems. Concurrent enrollment in BIO 3422 is recommended. (Credit cannot be earned for both AHS 2103 and BIO 3413.)

3422 General Physiology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 3413 is recommended. (Credit cannot be earned for both AHS 2111 and BIO 3422.)

3513 Biochemistry
(3-0) 3 hours credit. Prerequisites: CHE 2203 and 2242; BIO 2313 is also recommended.
Introduction to biochemistry: amino acids, protein structure, enzyme action, lipids, saccharides, metabolism, nucleic acids, and molecular biology. Concurrent enrollment in BIO 3522 is recommended.

3522 Biochemistry Laboratory
(0-6) 2 hours credit.
Basic biochemical laboratory techniques: titration, protein purification, enzyme kinetics, chromatography, electrophoresis, and centrifugation. Concurrent enrollment in BIO 3513 is recommended.

3533 Radiation Biology
(3-0) 3 hours credit. Prerequisite: BIO 2313 or consent of instructor.
A study of the biological effects of ionizing and non-ionizing radiation, cellular repair mechanisms, and medical applications of radiation. Concurrent enrollment in BIO 3542 is recommended.

3542 Radiation Biology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 3533 is recommended.

3613 The Biology of Aging
(3-0) 3 hours credit. Prerequisites: BIO 1203 and 1223.
The biological principles of human life and health; the changes which occur with aging and their implications for the lives of students and their families.

3633 Human Environmental Physiology
(3-0) 3 hours credit. Prerequisites: BIO 3413 or AHS 2103.
Adaptive physiological responses to unusual environmental conditions.

3713 Microbiology
(3-0) 3 hours credit. Prerequisites: BIO 2313 and CHE 2203.
A comprehensive study of microorganisms, including their composition, morphology, growth, metabolism, classification, ecology, and significance in disease. Concurrent enrollment in BIO 3722 is recommended. (Credit cannot be earned for both AHS 1053 and BIO 3713.)

3722 Microbiology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 3713 is recommended. (Credit cannot be earned for both AHS 1061 and BIO 3722.)

3733 Industrial Microbiology
(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722.
A study of genetic engineering of industrial microorganisms, industrial fermentation methodologies, quality control, and biotransformations used for the microbial manufacture of foods, beverages, antibiotics, enzymes, single-cell proteins, and industrial chemicals.

3813 Cellular Biology
(3-0) 3 hours credit. Prerequisite: BIO 3413 or 3513.
A study of cellular function with relation to structure, from the microscopic to molecular level. Concurrent enrollment in BIO 3822 is recommended.

3822 Cellular Biology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 3813 is recommended.

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 fieldwork will be included.

4073 Law, Ethics, and the Life Sciences
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212, or consent of instructor.
Current developments in biology such as recombinant DNA, embryo transplants, life-preserving processes, reproductive and population control, and the impact of biotechnology on enactment of new legislation and ethics in general.

4133 The Biotechnology of Malting and Brewing
(3-0) 3 hours credit. Prerequisites: BIO 3513, 3522, 3713, and 3722.
A study of the scientific principles underlying brewing and other fermentation technology.

4203 Plant Ecology
(3-0) 3 hours credit. Prerequisite: BIO 3283, 3292, or consent of instructor.
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. Concurrent enrollment in BIO 4221 is recommended.

4221 Plant Ecology Laboratory
(0-3) 1 hour credit.
A course providing the opportunity for field-oriented study to examine qualitative and quantitative methods to evaluate plant communities. Concurrent enrollment in BIO 4203 is recommended.

4233 Field Biology
(3-0) 3 hours credit. Prerequisites: BIO 1203, 1223, and 1212, or consent of instructor.
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. Concurrent enrollment in BIO 4241 is recommended.

4241 Field Biology Laboratory
(0-3) 1 hour credit.
A field-oriented course offering the opportunity for practical experience observing, collecting, and identifying Texas plants and animals. Concurrent enrollment in BIO 4233 is recommended.

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 and 2322.
Application of recombinant DNA techniques to the study of animals and plants in industry, medicine, and research. Concurrent enrollment in BIO 4352 is recommended.

4352 Molecular Genetics Laboratory
(0-6) 2 hours credit. Prerequisites: BIO 2313 and 2322.
A laboratory course emphasizing techniques for cloning, sequencing, and analyzing recombinant DNA molecules. Concurrent enrollment in BIO 4343 is recommended.

4353 Comparative Animal Physiology
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422.
A phylogenetic study of physiologic adaptation in animals.

4433 Neurobiology
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422.
Anatomy and physiology of nervous systems; the mechanisms of neuronal functions. Concurrent enrollment in BIO 4442 is recommended.

4442 Neurobiology Laboratory
(0-6) 2 hours credit.
A laboratory course emphasizing principles presented in BIO 4433. Concurrent enrollment in BIO 4433 is recommended.

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. Concurrent enrollment in BIO 4462 is recommended.

4462 Endocrinology Laboratory
(0-6) 2 hours credit.
A laboratory course emphasizing principles presented in BIO 4453. Concurrent enrollment in BIO 4453 is recommended.

4523 Intermediary Metabolism
(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522.
A detailed consideration of metabolic pathways and energy metabolism and their regulation.

4603 Plant Physiology
(3-0) 3 hours credit. Prerequisites: BIO 3343 and 3351, and CHE 2203 and 2242.
Principles of organization of cellular activity and molecular structure of protoplasm; includes nutrition, translocation, mineral metabolism, respiration, and photosynthesis. Concurrent enrollment in BIO 4611 is recommended.

4611 Plant Physiology Laboratory
(0-3) 1 hour credit.
A course providing qualitative and quantitative experiments in the study of plant physiology. Concurrent enrollment in BIO 4603 is recommended.

4723 Virology
(3-0) 3 hours credit. Prerequisite: BIO 3713.
A study of the diversity of viruses and biochemical mechanisms for their replication. Concurrent enrollment in BIO 4731 is recommended.

4731 Virology Laboratory
(0-3) 1 hour credit.
Concurrent enrollment in BIO 4723 is recommended.

4743 Immunology
(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522, or 3713 and 3722.
A study of the properties of antigens and antibodies and current concepts of humoral and cell-mediated immunity and the cells involved. Concurrent enrollment in BIO 4752 is recommended.

4752 Immunology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 4743 is recommended.

4763 Parasitology
(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722.
A study of the animal parasites of humans and related hosts, with emphasis on their epidemiology, life cycles, pathology, and control. Concurrent enrollment in BIO 4772 is recommended.

4772 Parasitology Laboratory
(0-6) 2 hours credit.
Concurrent enrollment in BIO 4763 is recommended.

4813 Brain and Behavior
(3-0) 3 hours credit. Prerequisite: BIO 1203, 1223, and 1212, or consent of instructor.
Basic physiological functions of the brain and how they relate to behavior.

4911-3 Independent Study
1-3 hours credit. (Hours arranged) Prerequisite: Permission in writing (form available) from the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4953 Special Studies in Biology
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary,

but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4963 Seminar in Biology
(3-0) 3 hours credit. Prerequisite: Minimum of 20 hours in biological sciences.
An undergraduate seminar which surveys selected biological topics through presentation and discussion of relevant contemporary research and literature. May not be repeated for credit. Limited to biology majors in their junior or senior year.

4972 MBRS-MARC Symposium
(2-0) 2 hours credit. Prerequisites: BIO 1203, 1223, and 1212; CHE 1103; or consent of instructor.
A course involving presentations at the frontiers of chemistry, biochemistry, biophysics, and biology, including genetics, microbiology, physiology, and other areas. Course may be repeated for credit, but not more than 6 hours may be applied to a bachelor's degree.

4993 Honors Research
3 hours credit. (Hours arranged) Prerequisites: Enrollment limited to candidates for Honors in Biology during their last two semesters and approval by the Division Honors Committee and faculty.
Supervised research and preparation of an honors thesis. May be repeated once with approval.

DIVISION OF MATHEMATICS, COMPUTER SCIENCE, AND STATISTICS

The Division offers a Bachelor of Science degree in Computer Science and a Bachelor of Science degree in Mathematics. The B.S. degree in Mathematics offers a concentration in Mathematics, a concentration in Statistics, or a concentration in General Mathematical Studies. The Division also offers minors in Computer Science, Mathematics, and Statistics.

BACHELOR OF SCIENCE DEGREE IN COMPUTER SCIENCE

The Bachelor of Science degree in Computer Science requires a minimum of 126 semester hours, including the Core Curriculum requirements.

All majors in computer science are required to complete all required and elective CS courses with a grade of "C" or better.

All candidates for the Bachelor of Science degree in Computer Science must complete the following:

A. 68 semester hours of required courses (including the 12 hours of Core Curriculum requirements in science, computer science, and mathematics):

CS	1714	Introduction to Computer Science
CS	1724	Data Structures I
CS	2413	Systems Programming
CS	2514	Computer Organization I
CS	2734	Computer Organization II
CS	3233	Discrete Mathematical Structures
CS	3323	Topics in Programming Languages
CS	3343	Analysis of Algorithms
CS	3733	Operating Systems
CS	3743	Data Base Management
CS	3773	Software Engineering
CS	4753	Computer Architecture
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
PHY	1904	Technical Physics I
PHY	1911	Technical Physics I Laboratory
PHY	1924	Technical Physics II

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

B. 12 semester hours of upper-division computer science courses (not to include CS 3073, 3133, or 4103).

C. 4 semester hours of electives.

MINOR IN COMPUTER SCIENCE

All students pursuing the minor in Computer Science must complete 21 semester hours:

A. 15 hours of required courses:

CS 1714 Introduction to Computer Science
CS 1724 Data Structures
CS 2413 Systems Programming
CS 2514 Computer Organization I

B. 6 hours of approved upper-division computer science electives.

To declare a minor in Computer Science, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Mathematics, Computer Science, and Statistics.

COURSE DESCRIPTIONS
COMPUTER SCIENCE
(CS)

1073 Introductory Computer Programming for Scientific Applications
(3-0) 3 hours credit. Prerequisite: MAT 1063.
Introductory programming. Sorting and ranking, plotting, numerical taxonomy, solution of non-linear equations, linear regression, and solution of linear systems. May not be applied toward a major in Computer Science.

1714 Introduction to Computer Science
(3-2) 4 hours credit. Prerequisite: MAT 1093.
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. (Formerly CS 1711 and CS 1713. Credit cannot be earned for both CS 1714 and either CS 1711 or CS 1713.)

1724 Data Structures
(3-2) 4 hours credit. Prerequisites: CS 1714 and MAT 1214.
Abstract data structures (stacks, queues, lists, trees), primitive operations, and methods of data representation. Dynamic memory allocation, pointers, and recursion, sorting, and searching. (Formerly CS 1723. Credit cannot be earned for both CS 1724 and CS 1723.)

2033 Fundamentals of Computer Concepts
(3-0) 3 hours credit. Prerequisite: Sophomore or higher classification.
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. Credit cannot be earned for both CS 1043 (formerly offered) and CS 2033. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics.

2073 Computer Programming With Engineering Applications
(3-0) 3 hours credit. Prerequisite: MAT 1214, and completion of or concurrent enrollment in 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 toward a major in Computer Science.

2083 Microcomputer Applications
(3-0) 3 hours credit.
Study of the uses of the computer and the organization and visualization of data. Topics will be selected from library searching, networking, e-mail, spreadsheets, data bases, authoring packages, multimedia and hypertext applications, presentation graphics, and legal/ethical issues. May not be applied toward a major in Computer Science.

2133 Microcomputer Programming
(3-0) 3 hours credit. Prerequisite: CS 2083.
Programming topics using the Pascal language. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics.

2413 Systems Programming
(3-0) 3 hours credit. Prerequisite: CS 1724.
A study of systems-level programming in a specific system (at present, Unix).

2514 Computer Organization I
(3-2) 4 hours credit. Prerequisite: CS 1724.
Introduction to theoretical concepts of digital logic design.

2734 Computer Organization II
(3-2) 4 hours credit. Prerequisite: CS 2514.
Assembly language programming and computer organization.

3073 Computer Graphics and Numerical Techniques
(3-0) 3 hours credit. Prerequisites: CS 2073 and MAT 3253.
Computer graphics, numerical analysis, and advanced programming techniques, with applications to engineering problems. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics.

3133 Computers and Society
(3-0) 3 hours credit. Prerequisite: Either CS 1073, 1714, 2033, 2073, 2083, 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 1724 and MAT 1223.
Survey and development of theoretical tools suitable for describing algorithmic applications. Propositional and predicate calculus, induction, proofs, set theory, and finite state automata.

3323 Topics in Programming Languages
(3-0) 3 hours credit. Prerequisite: CS 2413.
Study of two or three languages important to the computer science curriculum.

3343 Analysis of Algorithms
(3-0) 3 hours credit. Prerequisites: CS 2413, 3233, and MAT 2213.
Analysis of the performance of algorithms; discussion of programming techniques and data structures used in the writing of effective algorithms.

3413 Data Communications
(3-0) 3 hours credit. Prerequisite: CS 2734 or consent of instructor.
Concepts, principles, and terminology concerning the standards, equipment, interfaces, protocols, architectures, transmission alternatives, and regulatory issues involved in the design and use of data communications systems.

3723 Programming Languages
(3-0) 3 hours credit. Prerequisites: CS 3233 and 3323.
An introduction to the organization of high-level programming languages, including data types, control structures, data flow, and run time environments. Use of formal syntax descriptions. The implications of interpretation versus compilation. Activation records and dynamic storage in block structured languages.

3733 Operating Systems
(3-0) 3 hours credit. Prerequisites: CS 2734, 2413, and 3233.
An introduction to the functions and major techniques of a modern multiprogramming operating system. Includes exposure to the fundamentals of processor management, process synchronization, memory management, and peripheral management.

3743 Data Base Management
(3-0) 3 hours credit. Prerequisites: CS 2413 and 3233.
Study of systems for management of large amounts of related data. Basic concepts, implementation approaches, user data models, and commercially available systems.

3773 Software Engineering
(3-0) 3 hours credit. Prerequisites: CS 3323 and 3343.
Software development (analysis, specifications, design, implementation, and testing). Design methodologies and programming standards. Development project in small groups, including acceptance test.

3793 Introduction to Artificial Intelligence
(3-0) 3 hours credit. Prerequisites: CS 3323 and 3343.
Discussion of theorem proving by machine; includes computational linguistics, psychological modeling, and computer games.

4103 Ethical and Social Issues in Computer Science
(3-0) 3 hours credit. Prerequisite: CS 3733 or consent of instructor.
An introduction to formal ethics and its application to issues arising from the modern computer revolution. Topics include ethical problems related to specialized areas of computer science, such as large data bases, networks, artificial intelligence, and computer security. Legal issues are also covered.

4313 Automata, Computability, and Formal Languages
(3-0) 3 hours credit. Prerequisite: CS 3343.
Discussion of abstract machines (finite state automata, pushdown automata, and Turing machines), formal grammars (regular, context-free, and type 0) and the relationship among them.

4383 Computer Graphics
(3-0) 3 hours credit. Prerequisites: CS 3343 and MAT 2233.
An introduction to two- and three-dimensional generative computer graphics. Display devices, data structures, mathematical transformations, and algorithms used in picture generation, manipulation, and display.

4633 Simulation
(3-0) 3 hours credit. Prerequisites: CS 3233 and STA 3513.
Construction and use of simulation models on a digital computer. Monte Carlo techniques and associated statistical methods.

4713 Compiler Writing
(3-0) 3 hours credit. Prerequisites: CS 2734, 3323, and 3343.
An introduction to implementation of translators. Topics include formal grammars, scanners, parsing techniques, syntax-directed translation, 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.

4803 Microprocessor Laboratory
(1-4) 3 hours credit. Prerequisites: CS 2514 and 2734.
Principles of large-scale integration and very large-scale integration. Topics include the organization and systems architecture of state-of-the-art microprocessors, and the integration of microprocessors with random-access memory, programmable read-only memory, peripheral controllers, and I/O devices. (Formerly SD 4803. Credit cannot be earned for both CS 4803 and SD 4803.)

4853 Computer Interfaces
(3-0) 3 hours credit. Prerequisite: CS 2734.
Basic characteristics and design considerations of printer, tape, and disk controllers, multiplexers, and other devices for computer communications and teleprocessing. (Formerly SD 4853. Credit cannot be earned for both CS 4853 and SD 4853.)

4873 Computer Networks
(3-0) 3 hours credit. Prerequisites: CS 3733 and STA 3513.
Discussion of standard network layers, including issues of topology, error detection and recovery, congestion control, and hardware interfacing. (Formerly SD 4873. Credit cannot be earned for both CS 4873 and SD 4873.)

4901 Seminar in Computer Science
(1-0) 1 hour credit. Prerequisite: Upper-division classification in Computer Science.
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 in Computer Science.

4913 Independent Study
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 desiring specialized work. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4953 Special Studies in Computer Science
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research
(3-0) 3 hours credit. Prerequisite: Enrollment limited to candidates for College Honors during their last two semesters; approval by the College Honors Committee.
Supervised research and preparation of an honors thesis. May be repeated one time with approval.

BACHELOR OF SCIENCE DEGREE IN MATHEMATICS

The Bachelor of Science degree in Mathematics is offered with three concentrations: Mathematics, Statistics, or General Mathematical Studies.

The minimum number of semester hours required for this degree, including the Core Curriculum requirements, is 126. Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

Students choosing the concentration in General Mathematical Studies should satisfy the Core Curriculum requirements consistent with the Texas Teacher Certification Program.

All majors in Mathematics must complete all required and elective MAT and STA courses with a grade of "C" or better.

All candidates for the Bachelor of Science degree in Mathematics, regardless of concentration, must complete the following 28-29 semester hours of required courses (this includes the 6 hours of Core Curriculum requirements in mathematics and computer science):

CS 1073 Introductory Computer Programming for Scientific Applications
or
CS 1714 Introduction to Computer Science
or
CS 2073 Computer Programming with Engineering Applications
MAT 1214 Calculus I*
MAT 1223 Calculus II
MAT 2213 Calculus III
MAT 2233 Linear Algebra
MAT 3213 Foundations of Analysis
MAT 4213 Real Analysis I
STA 3513 Probability and Statistics
STA 3523 Statistical Methods

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

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

Concentration in Mathematics:

A. 15 semester hours of required courses:

MAT 3243 Calculus for Applications
MAT 3613 Differential Equations I
MAT 3633 Numerical Analysis
MAT 4223 Real Analysis II
MAT 4233 Modern Abstract Algebra I

B. 6 additional semester hours of upper-division courses in mathematics, computer science, or statistics, to be approved by the student's advisor.

C. 28-29 semester hours of electives.

Concentration in Statistics:

A. 18 semester hours of required courses:

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

B. 9 additional semester hours of approved courses in the Division. At least 6 of these must be upper-division.

C. 22-23 semester hours of electives.

Concentration in General Mathematical Studies:

A. 15 semester hours of mathematics and/or statistics:

1. 9 semester hours of mathematics:

MAT 3233 Modern Algebra
MAT 4113 Computer Mathematical Topics
MAT 4263 Geometry

2. 6 approved upper-division semester hours in mathematics or statistics.

B. 6 semester hours of required academic foundations:

COM 1043 Introduction to Communication
3 semester hours of English literature.

C. 28-29 semester hours of electives.

Students seeking teacher certification should use 21 of these hours for the required certification courses. Other students should take an additional 6 hours of upper-division MAT or STA courses approved by the Undergraduate Advisor of Record.

Certification requirements for students pursuing the concentration in General Mathematical Studies are different from degree requirements. In addition to specific course requirements, teacher certification in Texas also requires passing scores on the Texas Academic Skills Program (TASP) test and acceptable scores on the state-mandated exit competency test. Complete information may be obtained at the Office of Teacher Certification and Placement at UTSA.

MINOR IN MATHEMATICS

All students pursuing the minor in Mathematics must complete 22 semester hours:

A. 16 hours of required courses:

MAT 1214 Calculus I
MAT 1223 Calculus II
MAT 2213 Calculus III
MAT 2233 Linear Algebra
MAT 3613 Differential Equations

B. 6 hours of approved upper-division mathematics electives.

To declare a minor in Mathematics, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Mathematics, Computer Science, and Statistics.

COURSE DESCRIPTIONS
MATHEMATICS
(MAT)

0103 TASP Review
(3-0) 3 hours credit.
A course intended for students with minimal mathematical skills who need a comprehensive review before they can successfully complete an algebra course. Topics include the Fundamental Mathematics and Geometry objectives of the Texas Academic Skills Program (TASP), with an introduction to algebra. Intensive review and maintenance of computational skills with integers, fractions, decimals, percents, ratio, and proportions; reading and interpreting information presented in graphs, tables, and charts; solving word problems, elementary algebraic equations, and problems with two- and three-dimensional geometric figures; and inductive and deductive reasoning skills. Course does not count toward any degree at The University of Texas at San Antonio.

0113 Elemental Algebra
(3-0) 3 hours credit.
Introductory algebra course which includes the Texas Academic Skills Program (TASP) Algebra objectives. Operations with algebraic expressions; solve one- and two-variable equations; solve word problems involving one and two variables; graphing numbers and number relationships; solve problems involving quadratic equations. Course does not count toward any degree at The University of Texas at San Antonio.

0121 Elemental Geometry
(1-0) 1 hour credit.
Introductory course which includes the Texas Academic Skills Program (TASP) Geometry objectives. Solve problems with two- and three-dimensional geometric figures; solve problems involving right triangles using the Pythagorean Theorem; apply reasoning skills using the principles of similarity, congruence, parallelism, and perpendicularity; and inductive and deductive reasoning. Course does not count toward any degree at The University of Texas at San Antonio.

0131 Independent TASP Review
(1-0) 1 hour credit.
The opportunity to work with Self-Paced Instructional Modules or a Computerized Instructional Program to review concepts for the Texas Academic Skills Program (TASP) test. An individualized prescriptive program for each student will be developed by the TASP Mathematics Coordinator. Course does not count toward any degree at The University of Texas at San Antonio.

0133 Independent TASP Review
(3-0) 3 hours credit.
The opportunity to work at greater depth with Self-Paced Instructional Modules or a Computerized Instructional Program to review concepts for the Texas Academic Skills Program (TASP) test. An individualized prescriptive program for each student will be developed by the TASP Mathematics Coordinator. Course does not count toward any degree at The University of Texas at San Antonio.

1013 Fundamentals of 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, and functions and graphing of functions.

1033 Algebra with Calculus for Business
(3-0) 3 hours credit. Prerequisites: MAT 1013 or an equivalent course or placement.
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; and differentiation and integration. [TCCN: MATH 1325.]

1063 College Algebra
(3-0) 3 hours credit. Prerequisite: MAT 1013 or an equivalent course or placement.
Algebraic expressions; equations, inequalities over the real numbers, relations, functions, polynomial and rational functions, systems of linear equations and inequalities, matrices and determinants, complex numbers, polynomials, sequences, series, binomial expansion, mathematical induction, permutations, and combinations. [TCCN: MATH 1314.]

1093 Precalculus
(3-0) 3 hours credit. Prerequisite: MAT 1063 or an equivalent course or placement.
Exponential functions, logarithmic functions, trigonometric functions, complex numbers, DeMoivre's Theorem, and polar coordinates. [TCCN: MATH 2312.]

1143 Essential Elements in Mathematics
(3-0) 3 hours credit. Prerequisite: MAT 1063.
Numeration systems; properties of the systems of whole numbers, integers, rational numbers and real numbers; problem solving, geometry and measurement; probability and statistics; and logic. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics. [TCCN: MATH 1335.]

1214 Calculus I
(4-0) 4 hours credit. Prerequisite: MAT 1093 or an equivalent course or placement.
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. [TCCN: MATH 2413.]

1223 Calculus II
(3-0) 3 hours credit. Prerequisite: MAT 1214.
Methods of integration, inverse trigonometric functions, and applications of the integral. [TCCN: MATH 2314.]

2213 Calculus III
(3-0) 3 hours credit. Prerequisite: MAT 1223.
Special areas of differential and integral calculus; includes Taylor series, power series, convergence tests, vectors, functions of several variables, partial derivatives, and multiple integrals. [TCCN: MATH 2315.]

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. [TCCN: MATH 2318.]

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.

3123 Fundamentals of Geometry
(3-0) 3 hours credit. Prerequisite: MAT 1214.
A survey of geometric concepts, including axiomatic developments of advanced Euclidean geometry, coordinate geometry, non-Euclidean geometry, 3-dimensional geometry, and topology. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics other than the General Mathematical Studies concentration of the B.S. degree in Mathematics.

3213 Foundations of Analysis
(3-0) 3 hours credit. Prerequisites: MAT 2213 (2243 recommended).
Rigorous development of the foundations of real analysis; basic point set topology in R^1 and R^n; compactness; connectedness; convergence; and cardinality. Emphasis on theorem proving and mathematical rigor.

3223 Complex Variables
(3-0) 3 hours credit. Prerequisites: MAT 2213 and either 3213 or consent of instructor.
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 1214.
Topics will include the development of groups, integral domains, fields, and number systems including the complex numbers. Divisibility, congruences, primes, perfect numbers, and some other problems of number theory will be considered.

3243 Calculus for Applications
(3-0) 3 hours credit. Prerequisite: MAT 2233.
Line vector differential and integral calculus, line integrals, Green's theorem, Stokes' theorem, and Divergence theorem.

3253 Engineering Analysis I
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Ordinary differential equations, Laplace transforms, linear algebra, and matrix arithmetic. May not be applied to a major in the Division of Mathematics, Computer Science, and Statistics.

3263 Engineering Analysis II
(3-0) 3 hours credit. Prerequisite: MAT 3253.
Fourier series, partial differential equations, vector calculus, linear difference equations, Z-transforms, and complex analysis. May not be applied to a major in the Division of Mathematics, Computer Science, and Statistics.

3613 Differential Equations I
(3-0) 3 hours credit. Prerequisite: Completion of 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, and power series solutions of differential equations.

3623 Differential Equations II
(3-0) 3 hours credit. Prerequisite: MAT 3613.
Continuation of MAT 3613. Stability, partial differential equations, and boundary value problems.

3633 Numerical Analysis
(3-0) 3 hours credit. Prerequisites: MAT 2233 and either CS 1073 or CS 1714.
Solution of linear and non-linear equations, curve-fitting, and eigenvalue problems.

4113 Computer Mathematical Topics
(3-0) 3 hours credit. Prerequisites: MAT 3233 and either 3123 or 4263.
Mathematical topics from consumer mathematics, algebra, geometry, number theory, and probability and statistics will be investigated using the computer. Course will also include some instruction in the BASIC programming language. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics other than the General Mathematical Studies concentration of the B.S. degree in Mathematics.

4123 History of Mathematics
(3-0) 3 hours credit. Prerequisites: MAT 3233 and either 3123 or 4263.
Selected subjects in mathematics developed through historical perspectives and biographies. May not be applied toward a major in the Division of Mathematics, Computer Science, and Statistics other than the General Mathematical Studies concentration of the B.S. degree in Mathematics.

4213 Real Analysis I
(3-0) 3 hours credit. Prerequisite: MAT 3213.
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, and interchange of limits.

4223 Real Analysis II
(3-0) 3 hours credit. Prerequisite: MAT 4213.
An in-depth study of the calculus of functions of several real variables; differentiation, Jacobians, non-linear transformations, and integration.

4233 Modern Abstract Algebra I
(3-0) 3 hours credit. Prerequisite: MAT 3213.
An in-depth study of groups and rings.

4253 Number Theory
(3-0) 3 hours credit. Prerequisite: MAT 3213.
The theory of primes, congruences, and related subjects.

4263 Geometry
(3-0) 3 hours credit. Prerequisite: MAT 3213.
Projective, affine, and non-Euclidean geometry.

4273 Topology
(3-0) 3 hours credit. Prerequisite: MAT 3213.
Set theory, including cardinal and ordinal numbers. Topological properties of the real line and metric spaces.

4913 Independent Study
(3-0) 3 hours credit. Prerequisites: Permission in writing (form available) of the instructor, the student's advisor, and the Division Director and Dean of the College in which the course is offered.
Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4953 Special Studies in Mathematics
(3-0) 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. May be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.

4993 Honors Research
3 hours credit. Prerequisites: 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.

MINOR IN STATISTICS

All students pursuing the minor in Statistics must complete 22 semester hours:

A. 19 hours of required courses:

MAT 1214 Calculus I
MAT 1223 Calculus II

MAT 2213 Calculus III
MAT 2233 Linear Algebra
STA 3513 Probability and Statistics
or
STA 3533 Probability and Random Processes
STA 3523 Statistical Methods

B. 3 hours of approved upper-division statistics electives.

To declare a minor in Statistics, to obtain advice, or to seek approval of substitutions for course requirements, students should consult the Undergraduate Advisor of Record in the Division of Mathematics, Computer Science, and Statistics.

COURSE DESCRIPTIONS
STATISTICS
(STA)

1053 Basic Statistics
(3-0) 3 hours credit. Prerequisite: MAT 1013, 1033, or MAT 1063.
Descriptive statistics; histograms; measures of location and dispersion; elementary probability theory; random variables; binomial and normal distributions; interval estimation and hypothesis testing; simple linear distributions; simple linear regression and correlation; and applications of the chi-square distribution. [TCCN: MATH 1342.]

1063 Basic Statistics for Business and Economics
(3-0) 3 hours credit. Prerequisite: MAT 1033.
Fundamental concepts and procedures of statistics and probability with business applications. Includes descriptive statistics, estimation, hypothesis testing, and simple linear regression and correlation. (Formerly STA 1064. Credit cannot be earned for both STA 1063 and 1064.)

1073 Statistics for Psychology
(3-0) 3 hours credit. Prerequisites: MAT 1013 and one psychology course.
The use of statistics in psychological research. Includes elementary probability theory; descriptive statistics, including histograms, graphing, and measures of central tendency and dispersion; correlational techniques; binomial and normal distributions; and inferential statistics, including hypothesis testing, interval estimation, and analysis of variance.

1993 Statistical Methods for the Life and Social Sciences
(3-0) 3 hours credit. Prerequisite: STA 1053, 1063, or 1073.
Point estimator properties, inference about the means and variances of two or more populations, categorical data analysis, linear regression, analysis of variance, and 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, discriminant analysis, cluster analysis, principal components,

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

3433 Applied Non-Parametric Statistics
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.
Tests of location, goodness-of-fit tests, rank tests, tests based on nominal and ordinal data for both related and independent samples, and measures of association.

3513 Probability and Statistics
(3-0) 3 hours credit. Prerequisite: Completion of or concurrent enrollment in MAT 2213.
Axioms of probability, probability functions, density functions, random variables, functions of random variables and their sampling distributions, and important discrete and continuous random variables.

3523 Statistical Methods
(3-0) 3 hours credit. Prerequisite: STA 3513 or 3533.
Estimation and testing hypotheses, chi-square tests, linear regression, analysis of variance, and other topics which may include nonparametric methods, quality control, and reliability.

3533 Probability and Random Processes
(3-0) 3 hours credit. Prerequisites: EE 3423 and MAT 3253.
Probability, random variables, distribution and density functions, limit theorems, random processes, correlation functions, power spectra, and response of linear systems to random inputs.

3813 Discrete Data Analysis and Bioassay
(3-0) 3 hours credit. Prerequisites: STA 1993 or 3523.
Methods especially useful for problems arising in the life sciences: analysis of count data, contingency tables, and Probit and Logit analysis.

4613 Operations Research I
(3-0) 3 hours credit. Prerequisite: 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, and introduction to dynamic programming.

4623 Operations Research II
(3-0) 3 hours credit. Prerequisite: STA 3513 or an equivalent.
Introduction to probabilistic analysis and models in operations research. Decision analysis, Markov chains, and queuing models.

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, and 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, and non-linear regression.

4723 Design and Analysis of Experiments
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.
General concepts in the design and analysis of experiments. Emphasis will be placed on both the experiment design and analysis and tests of the validity of assumptions. Topics covered include completely randomized designs, randomized block designs, complete factorials, fractional factorials, and covariance analysis. The use of computer software packages will be stressed.

4803 Statistical Quality Control
(3-0) 3 hours credit. Prerequisite: STA 3513.
Statistics and simple probability are introduced in terms of problems which arise in manufacturing and their application to control of manufacturing processes. Includes acceptance sampling in terms of standard sampling plans: MIL-STD 105, MIL-STD 414, Dodge-Romig plans, continuous plans, etc.

4903 Survival Analysis
(3-0) 3 hours credit. Prerequisite: STA 3523 or an equivalent.
Measures of survival, hazard function, means residual life function, common failure distributions and a procedure for selecting an appropriate model, reliability of complex series and parallel systems, and the probabilistic approach to biomedical applications.

4953 Special Studies in Statistics
(3-0) 3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a bachelor's degree.