

COLLEGE OF SCIENCES AND MATHEMATICS

DIVISION OF ALLIED HEALTH AND LIFE SCIENCES

The Division offers a Bachelor of Science Degree in Biology and Allied Health programs leading to Bachelor of Science Degrees in Medical Technology, Occupational Therapy, and Physical Therapy. Also available are preprofessional courses to help prepare students for admission to medical, dental, and nursing school.⁴⁴

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

There are two programs at UT San Antonio that lead to a B.S. Degree in Medical Technology. One program consists of three years of academic work and twelve months of clinical laboratory training in a hospital school of medical technology approved by the Council of Education of the American Medical Association. The second program is a four-year integrated program in which clinical training is introduced at the beginning of the program and in which there is a concentrated clinical hospital experience in the latter part of the program. The integrated program is offered in cooperation with The University of Texas Health Science Center at San Antonio. Graduates of both the three-plus-one and the integrated programs may obtain certification by passing the examination of the Board of Registry of the American Society of Clinical Pathologists.

The Bachelor of Science Degree in Occupational Therapy provides the student with a strong background in the life sciences, behavioral sciences, humanities, and special skill areas. Specific application of occupational therapy skills in laboratory and clinical settings occurs in the last two years of a student's program and includes a minimum of six months approved field work experience. Upon completion of the degree program the student is eligible to take the national examination for registration with the American Occupational Therapy Association.

The Bachelor of Science Degree program in Physical Therapy emphasizes the biological and physical sciences essential for understanding the functioning of the human body, as well as the humanities, social sciences, and skill areas. Preclinical and clinical experience is taken in the last two years of a student's program. Upon completion of the degree program the student is eligible to take licensure examinations.

Special Admission Requirements for Upper-Division Allied Health Sciences Courses. Acceptance into The University to major in Medical Technology, Occupational Therapy, and Physical Therapy does not indicate acceptance into the upper-division Allied Health Sciences courses. Admission requirements for those courses are:

- 1) completion of pre-professional requirements with a minimum grade of "C" in each course;
- 2) a minimum cumulative GPA of 2.8 in all pre-professional courses;

⁴⁴Specific premedical, predental, and prenursing programs are not offered at UT San Antonio. Admission requirements for these professional schools are outlined in the Appendix of this catalog. Additional information can be obtained from the Office of the Division of Allied Health and Life Sciences and through the Chairman of the Health Related Professions Advisory Committee of The University of Texas at San Antonio.

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- 3) a satisfactory score on the Allied Health Professions Admission Test;
- 4) a report from the student's personal physician regarding the applicant's physical and mental health; and
- 5) a personal interview for selected applicants.

Acceptance into the Three-Plus-One Medical Technology program does not guarantee the student a position in the final year of clinical training. UT San Antonio students compete with students from other universities for the available internships at hospital schools of medical technology. Securing the fourth year clinical training is the student's responsibility. The Director of the Medical Technology Program assists the students in this regard, but the final decisions upon acceptance are made by individual hospitals.

Acceptance into the junior year of the Integrated Medical Technology program guarantees a student a continued position in the upper-division Allied Health Science courses, as long as he or she maintains at least a 2.5 cumulative grade-point average.

BACHELOR OF SCIENCE DEGREE IN BIOLOGY

The minimum number of semester hours required for the Bachelor of Science Degree in Biology, including the 50 hours of General Education Requirements, is 126.⁴⁵

All candidates for the degree must complete:

- A. 45 semester hours in the *major*, 22 of which must be at the upper-division level.
 1. 25 semester hours in the Biology Core Curriculum are required:

BIO 1103, 1112	Principles of Biology and Laboratory
BIO 1213, 1222	Principles of Environmental Biology and Laboratory
BIO 2313, 2322	Genetics and Laboratory
BIO 3413, 3422	General Physiology and Laboratory
BIO 3513, 3522	Biochemistry and Laboratory
 2. 20 additional semester hours of Biology electives are required, 12 of which must be at the upper-division level in consultation with the student's Advisor. The Biology electives may be selected from any of the Biology courses, except those for non-majors, and from certain Allied Health Sciences courses.
- B. 24 semester hours of *support work*.
 1. 13 semester hours are required in Chemistry:

CHE 1103	Introductory Chemistry
CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis
CHE 2203	Organic Chemistry I
CHE 2212	Organic Qualitative Analysis
 2. 3 semester hours (in addition to the 4 semester hours required under the General Education Requirements) are required in Mathematics:

MAT 2013	Statistical Methods for the Life and Social Sciences or
MAT 1213	Calculus I

⁴⁵Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

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3. 8 semester hours are required in Physics:

PHY 1803, 1811 Physics for Life Sciences I and Laboratory
PHY 1823, 1831 Physics for Life Sciences II and Laboratory

- C. 7 semester hours of *free electives*.

BACHELOR OF SCIENCE DEGREE IN MEDICAL TECHNOLOGY

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 146.

THREE-PLUS-ONE PROGRAM

- A. 75 semester hours are required in the *major*.

1. 26 semester hours in the biological sciences:

BIO 1103, 1112 Principles of Biology and Laboratory
BIO 2313 Genetics
BIO 3513, 3522 Biochemistry and Laboratory
BIO 3713, 3722 Microbiology and Laboratory
BIO 4743, 4751 Immunology and Laboratory
BIO 4763, 4771 Parasitology and Laboratory

2. 49 semester hours are required in Allied Health Sciences.

AHS 1871 Allied Health Sciences
AHS 1883 Introduction to Medical Technology
AHS 3463, 3471 Human Physiology and Laboratory
AHS 4783, 4792 Pathogenic Microorganisms and Laboratory
AHS 4942-9 Clinical Field Work Experience — Level II (to be repeated during the 12 month hospital training for a total of 36 hours: 12 hours in each of Fall, Spring and Summer semesters).

- B. 21 hours of *support work*.

1. 13 semester hours are required in Chemistry:

CHE 1103 Introductory Chemistry
CHE 2003 Chemical Principles
CHE 2012 Inorganic Qualitative and Quantitative Analysis
CHE 2203 Organic Chemistry I
CHE 2212 Organic Qualitative Analysis

2. 8 semester hours are required in Physics:

PHY 1803, 1811 Physics for Life Sciences I and Laboratory
PHY 1823, 1831 Physics for Life Sciences II and Laboratory

INTEGRATED PROGRAM

- A. 75 semester hours in the *major*.

1. 22 semester hours are required in the biological sciences:

BIO 1103, 1112 Principles of Biology and Laboratory
BIO 2313 Genetics
BIO 3513, 3522 Biochemistry and Laboratory
BIO 3713, 3722 Microbiology and Laboratory
BIO 4743, 4751 Immunology and Laboratory

2. 53 semester hours are required in Allied Health Sciences:

AHS 1871	Allied Health Sciences
AHS 1883	Introduction to Medical Technology
AHS 2412, 2422	Hematology and Laboratory
AHS 2533, 2542	Parasitology and Urinalysis and Laboratory
AHS 3463, 3471	Human Physiology and Laboratory
AHS 3773, 3782	Clinical Chemistry and Laboratory
AHS 3862, 3872	Immunohematology and Serology and Laboratory
AHS 4783, 4792	Pathogenic Microorganisms and Laboratory
AHS 4843	Advanced Clinical Microbiology
AHS 4854	Advanced Clinical Chemistry
AHS 4863	Advanced Clinical Hematology
AHS 4884	Advanced Immunohematology and Serology
AHS 4942-8	Clinical Field Work Experience — Level II (to be repeated during the two-semester hospital training experience for a total of 8 hours)

B. 21 semester hours of *support work*.

1. 13 semester hours are required in Chemistry:

CHE 1103	Introductory Chemistry
CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis
CHE 2203	Organic Chemistry I
CHE 2212	Organic Qualitative Analysis

2. 8 semester hours are required in Physics:

PHY 1803, 1811	Physics for Life Sciences I and Laboratory
PHY 1823, 1831	Physics for Life Sciences II and Laboratory

BACHELOR OF SCIENCE DEGREE IN OCCUPATIONAL THERAPY⁴⁶

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 158.⁴⁷

All candidates for the degree must complete:

A. 98 semester hours in the *major*, 87 of which must be at the upper-division level.

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

BIO 1103, 1112	Principles of Biology and Laboratory
BIO 2123, 2131	Comparative Anatomy of Vertebrates and Laboratory

2. 89 semester hours are required in Allied Health Sciences:

AHS 1871	Allied Health Sciences
AHS 1891	Survey of Physical Medicine and Rehabilitation
AHS 3002	Principles of Practice
AHS 3012	Introductory Pathology
AHS 3164, 3174	Human Anatomy and Laboratory
AHS 3212	Occupational Therapy Media I
AHS 3223	Occupational Therapy Media II

⁴⁶This degree program will not be implemented in 1978-79, although individual courses in Occupational Therapy may be scheduled. Class schedules for specific terms should be consulted.

⁴⁷Three semester hours in Sociology and six additional semester hours in Psychology in Group C electives are selected as part of the General Education Requirements, with the approval of the student's Advisor.

BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY / 205

AHS 3463, 3471	Human Physiology and Laboratory
AHS 3752, 3761	Dynamics of Motion I and Laboratory
AHS 3793	Occupational Therapy Theory I
AHS 3802	Clinical Medicine I
AHS 3812	Clinical Seminar
AHS 3902	Occupational Therapy Skills Laboratory I
AHS 3924	Clinical Field Work Experience Level I
AHS 4003	Clinical Medicine II
AHS 4013	Clinical Medicine III
AHS 4023	Occupational Therapy Skills Laboratory II
AHS 4033	Occupational Therapy Skills Laboratory III
AHS 4043	Occupational Therapy Media III
AHS 4053	Occupational Therapy Theory II
AHS 4463, 4471	Human Neurosciences and Laboratory
AHS 4501	Seminar in Rehabilitation
AHS 4803	Occupational Therapy Theory III
AHS 4823	Allied Health Management and Consultation
AHS 4923	Special Project
AHS 4949	Clinical Field Work Experience — Level II (repeated for a total of 18 hours credit)

B. 10 semester hours of *support work*.

1. 4 semester hours are required in Chemistry:

CHE 1003, 1111	General Chemistry for Allied Health Sciences and Laboratory
or	

CHE 1103, 1122	Introductory Chemistry and Laboratory Workshop
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2. 6 semester hours are required in Psychology:

PSY 2513	Abnormal Psychology
PSY 2523	Personality

BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 153.⁴⁸

All candidates for the degree must complete:

A. 87 semester hours in the *major*, 76 of which must be at the upper-division level.

1. 14 semester hours are required in Biology.

BIO 1103, 1112	Principles of Biology and Laboratory
BIO 2123, 2131	Comparative Anatomy of Vertebrates and Laboratory
BIO 3413, 3422	General Physiology and Laboratory

2. 73 semester hours are required in Allied Health Sciences courses:

AHS 1871	Allied Health Sciences
AHS 1891	Survey of Physical Medicine and Rehabilitation
AHS 3012	Introductory Pathology
AHS 3164	Human Anatomy
AHS 3174	Human Anatomy Laboratory
AHS 3201	Physical Therapy: History and Philosophy
AHS 3302	Physical Therapy Procedures

⁴⁸Three semester hours in Sociology and six additional semester hours in Psychology in Group C electives are selected as part of the General Education Requirements, with the approval of the student's Advisor.

AHS 3752	Dynamics of Motion I
AHS 3761	Dynamics of Motion I Laboratory
AHS 3881	Therapeutic Concepts and Procedures in Physical Therapy
AHS 3892	Therapeutic Concepts Laboratory
AHS 3926	Clinical Field Work Experience — Level I
AHS 4003	Clinical Medicine II
AHS 4013	Clinical Medicine III
AHS 4202	Dynamics of Motion II
AHS 4211	Dynamics of Motion II Laboratory
AHS 4222	Advanced Concepts and Procedures in Physical Therapy
AHS 4231	Advanced Concepts and Procedures in Physical Therapy Laboratory
AHS 4301	Clinical Education (repeated for a total of 4 credit hours)
AHS 4313	Therapeutic Exercise I
AHS 4323	Therapeutic Exercise II
AHS 4413	Mammalian Physiology
AHS 4421	Mammalian Physiology Laboratory
AHS 4463	Human Neurosciences
AHS 4471	Human Neurosciences Laboratory
AHS 4501	Seminar in Rehabilitation
AHS 4823	Allied Health Management and Consultation
AHS 4923	Special Project
AHS 4949	Clinical Field Work Experience — Level II

B. 16 semester hours of *support work*.

1. 9 semester hours are required in Chemistry:

CHE 1103	Introductory Chemistry
CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis

2. 8 semester hours are required in Physics:

PHY 1803, 1811	Physics for Life Sciences I and Laboratory
PHY 1823, 1831	Physics for Life Sciences II and Laboratory

COURSE DESCRIPTIONS

BIOLOGY (BIO)

1013 Life and Living Systems

(3-0) 3 hours credit. May not be applied to a major in this Division.

An introduction to the life sciences emphasizing general principles, diversity of life forms, reproduction and interrelationships between living things. Credit cannot be earned for both BIO 1013 and BIO 1103.

1021 Life and Living Systems Laboratory

(0-3) 1 hour credit. May not be applied to a major in this Division. Must be taken concurrently with BIO 1013. Laboratory exercises, films and demonstrations in biology. Credit cannot be earned for both BIO 1021 and BIO 1112.

1103 Principles of Biology

(3-0) 3 hours credit.

An introduction to living organisms emphasizing fundamentals of organization, reproduction, growth and interrelationships between various forms of life. Required for students majoring in Biology. Credit cannot be earned for both BIO 1013 and BIO 1103.

1112 Principles of Biology Laboratory

(0-6) 2 hours credit. Must be taken concurrently with BIO 1103.

1213 Principles of Environmental Biology

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

The interaction of organisms with their environment, ecological principles, adaptations of organisms, ecology, environmental pollution and principles of conservation.

1222 Principles of Environmental Biology Laboratory

(0-6) 2 hours credit. Biology majors must take this concurrently with BIO 1213; optional for non-majors.

2003 Human Reproduction, Fertility, and Demography

(3-0) 3 hours credit. Prerequisites: BIO 1013 or 1103 or consent of instructor. May not be applied to a major in this Division.

Human reproductive anatomy and physiology, fertility control, reproductive disease, and parameters influencing fertility patterns.

2053 Man and His Environment

(3-0) 3 hours credit. Prerequisite: BIO 1013 or 1103 or consent of instructor. May not be applied to a major in this Division.

The interaction of man with the ecosystem and its consequences.

2063 Invertebrate Biology

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

A comprehensive treatment of the invertebrate animals with emphasis on their taxonomy, morphology, ecology, and evolution.

2071 Invertebrate Biology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 2063.

2123 Comparative Anatomy of Vertebrates

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

A detailed study of anatomical differences and similarities of vertebrates with reference to evolutionary changes.

2131 Comparative Anatomy of Vertebrates Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 2123.

2162 Histology and Cytology

(2-0) 2 hours credit. Prerequisites: BIO 1103, 1112.

The cytological and histological aspects of cellular organization.

2172 Histological and Cytological Laboratory

(0-6) 2 hours credit. Must be taken concurrently with BIO 2162.

2313 Genetics

(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 1103, 2003, and one year of college algebra.

Principles governing transmission of hereditary factors in plants and animals with emphasis on molecular, biochemical and population genetics.

2322 Genetics Laboratory

(0-6) 2 hours credit. Must be taken concurrently or following BIO 2313. Optional for non-majors.

3003 Introduction to Oceanography

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

General oceanography with emphasis on biological aspects integrated into a conceptual approach to the sciences of the sea.

3012 Introductory Pathology

(2-0) 2 hours credit. Prerequisites: BIO 1103, 1112 or AHS 2103.
Concepts of disease and diagnosis of pathological conditions.

3023 Drugs and Society

(3-0) 3 hours credit. May not be applied to a major in this Division.
An examination of drugs and their role in society.

3083 Biosocial Genetics

(3-0) 3 hours credit. May not be applied to a major in this Division.
A study of human heredity and social issues with emphasis on inherited diseases, genetic problems and evolutionary change in relation to culture, diversity and mating systems.

3143 Comparative Vertebrate Embryology

(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422.
Sequential analysis of development in vertebrates and the factors which effect fertilization organogenesis and implantation.

3151 Comparative Vertebrate Embryology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 3143.

3203 Plant Ecology

(3-0) 3 hours credit. Prerequisite: BIO 1213, 1222 or consent of instructor.
The major biomes of North America and Texas will be studied, including the chemical, physical and biological factors that influence the development of these biomes.

3211 Plant Ecology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 3203.
Laboratory will include four weekend field trips to major biomes of Texas. Qualitative and quantitative methods used to evaluate plant communities will be examined.

3213 Animal Ecology

(3-0) 3 hours credit. Prerequisites: BIO 1213, 1222.
A detailed study of populations, interrelationships, behavior patterns and physiological responses of animals to their environment.

3221 Animal Ecology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 3213.

3233 Rural and Municipal Sanitation

(3-0) 3 hours credit. Prerequisites: BIO 1213, CHE 2003 and upper-division standing.
An examination of sanitation practices in rural and urban environments; including insect and rodent control, swimming pool sanitation, rural water supply, food sanitation and disease transmission.

3242 Field Biology and Ecology

(2-0) 2 hours credit. Prerequisite: BIO 1103, 1112 or consent of instructor.
A study of plants and animals in their natural environment; field trips, collection and analysis of field data are included.

3251 Field Biology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 3242.

3323 Evolution

(3-0) 3 hours credit. Prerequisite: BIO 2313.
A discussion of theories and possibly mechanisms for evolutionary changes at various levels of organization.

3343 Plant Sciences

(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112.
The life histories and phylogenetic relationships of vascular and non-vascular plants.

3351 Plant Sciences Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 3343.

- 3413 General Physiology**
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 2203, 2212.
Fundamental properties and processes in living systems.
- 3422 General Physiology Laboratory**
(0-6) 2 hours credit. Must be taken concurrently with BIO 3413.
- 3513 Biochemistry**
(3-0) 3 hours credit. Prerequisites: CHE 2203, 2212; BIO 2313 recommended.
Introduction to biochemistry: amino acids; protein structures; enzyme action; lipids and saccharides; metabolism; nucleic acids and molecular biology.
- 3522 Biochemistry Laboratory**
(0-6) 2 hours credit. Must be taken concurrently or following BIO 3513.
Basic biochemical laboratory techniques: titration, protein purification, enzyme kinetics, chromatography, electrophoresis, centrifugation.
- 3533 Radiation Biology**
(3-0) 3 hours credit. Prerequisites: BIO 3513, 3522.
Interactions of ionizing ultraviolet and visible radiations with matter; biological effects; cellular repair of radiation damage; biological photo-receptors.
- 3541 Radiation Biology Laboratory**
(0-3) 1 hour credit. Must be taken concurrently with BIO 3533.
- 3633 Plant Anatomy**
(3-0) 3 hours credit. Prerequisites: BIO 3343, 3351.
A comprehensive treatment of the internal structure of vascular plants. Emphasis will be on leaf, flower, fruit, stem and root anatomy.
- 3641 Plant Anatomy Laboratory**
(0-3) 1 hour credit. Must be taken concurrently with BIO 3633.
- 3713 Microbiology**
(3-0) 3 hours credit. Prerequisites: BIO 3513, 3522 or concurrent registration.
A comprehensive study of microorganisms including their composition, morphology, growth, metabolism, classification, ecology and significance in disease.
- 3722 Microbiology Laboratory**
(0-6) 2 hours credit. Must be taken concurrently with BIO 3713.
- 3732 Industrial Microbiology**
(2-0) 2 hours credit. Prerequisites: BIO 3713, 3722.
A study of fermentations of industrial importance, food processing, and quality control.
- 3741 Industrial Microbiology Laboratory**
(0-3) 1 hour credit. Must be taken concurrently with BIO 3732.
- 3813 Cellular Biology**
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3513.
The composition, function and interaction of cellular constituents and substructures at the ultra-structural level.
- 3821 Cellular Biology Laboratory**
(0-3) 1 hour credit. Must be taken concurrently with BIO 3813.
- 3831 Tissue and Organ Culture**
(1-0) 1 hour credit. Prerequisites: BIO 3513, 3522.
Theoretical and practical aspects of maintaining and growing cells, tissues and organs from various sources.
- 3842 Tissue and Organ Culture Laboratory**
(0-6) 2 hours credit. Must be taken concurrently with BIO 3831.
- 4003 Principles of Marine Biology**
(3-0) 3 hours credit. Prerequisite: BIO 1213.
The fauna and flora of marine ecosystems with special emphasis on the North-western Gulf Coast.

4011 Principles of Marine Biology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4003.

Shallow and deep water collection, identification and observation. Some weekend field trips required.

4022 Limnology

(2-0) 2 hours credit. Prerequisites: BIO 1213.

Ecology of inland waters with emphasis on functional aspects of lake ecosystems, productivity and nutrient relations of plankton, pollution and eutrophication.

4032 Limnology Laboratory

(0-6) 2 hours credit. Must be taken concurrently with BIO 4022.

Comparative limnology of Texas lakes and streams supported by laboratory analysis of biological material collected in water samples.

4073 Law, Ethics and the Life Sciences

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

May not be applied to a major in this Division. An examination of the ethical, philosophical and social implications of studies in those areas of the life sciences which affect public policy or action, e.g., incentives to slow population growth; psychology of consciousness and definitions of life and death.

4243 Physiological Ecology

(3-0) 3 hours credit. Prerequisites: BIO 3213, 3221, 3242, 3251.

An integration of physiological and biochemical solutions and mechanisms to environmental problems at the organismic level.

4251 Physiological Ecology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4243.

4333 Population Genetics

(3-0) 3 hours credit. Prerequisites: BIO 2313, 2322.

A quantitative approach to the study of genetics systems in populations, including mutations, selection, polymorphism and mating systems.

4343 Molecular Genetics

(3-0) 3 hours credit. Prerequisites: BIO 2313, 2322, 3513, 3522.

Molecular approach to structure, replication, mutation and phenotypic expression of genetic material.

4353 Comparative Physiology

(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422.

A phylogenetic study of physiologic adaptation in animals.

4361 Comparative Physiology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4353.

A laboratory course illustrating the principles presented in BIO 4353.

4433 Neurobiology

(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422.

Anatomy and physiology of nervous systems, the mechanisms of neuronal functions.

4443 Endocrinology

(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422, 3513, 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.

4451 Endocrinology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4443.

4493 Air Pollution and Industrial Hygiene

(3-0) 3 hours credit. Prerequisites: BIO 1213, CHE 2003 and upper-division standing.

Discussion of the sources, quantities, effects of sampling and control of airborne pollutants in ambient air and industrial environments.

4523 Intermediary Metabolism

(3-0) 3 hours credit. Prerequisites: BIO 3513, 3522.

A detailed consideration of metabolic pathways, energy metabolism and their regulation.

4543 Biochemical Techniques

(0-6) 3 hours credit. Prerequisites: BIO 3513, 3522.

Laboratory experience in methods of biochemical fractionation, purification and analysis of components.

4603 Plant Physiology

(3-0) 3 hours credit. Prerequisites: BIO 3343, 3351, CHE 2203, 2212.

Principles of organization of cellular activity and molecular structure of protoplasm; nutrition, translocation, mineral metabolism, respiration and photosynthesis.

4611 Plant Physiology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4603.

4622 Biological Literature

(2-0) 2 hours credit. Prerequisite: senior standing.

Survey of selected biological references with emphasis on utilization of journals and scientific writing.

4723 Virology

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

A study of the diversity of viruses and biochemical mechanisms for their replication.

4731 Virology Laboratory

(0-3) 1 hour credit. Must be taken with or following BIO 4723.

4743 Immunology

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

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

4751 Immunology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4743.

4763 Parasitology

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

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

4771 Parasitology Laboratory

(0-3) 1 hour credit. Must be taken concurrently with BIO 4763.

4911-3 Independent Study

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

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

4923 Special Project

(2-9) 3 hours credit. Prerequisite: Consent of Division Director.

An intensive supervised student project.

4963 Special Studies in Biology

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

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

4973 Proseminar

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

Presentation and discussion of current scientific literature.

COURSE DESCRIPTIONS ALLIED HEALTH SCIENCES (AHS)

- 1053 Introductory Microbiology**
(3-0) 3 hours credit. Prerequisite: BIO 1013 or 1103 or consent of instructor.
May not be applied to a major in this Division. A general study of microorganisms, their characteristics, isolation, growth, and importance in nature, industry, public health and human disease.
- 1061 Introductory Microbiology Laboratory**
(0-3) 1 hour credit.
May not be applied to a major in this Division. Must be taken concurrently with AHS 1053.
- 1871 Allied Health Sciences**
(1-0) 1 hour credit.
Nature of the various allied health science programs and their interrelation. On-site hospital visits to the various programs.
- 1883 Introduction to Medical Technology**
(3-0) 3 hours credit. Prerequisite: AHS 1871.
Clinical laboratory safety, specimen collection and preservation, quality controls, medical laboratory calculations, reagent preparation and medical technical terminology.
- 1891 Survey of Physical Medicine and Rehabilitation**
(1-0) 1 hour credit. Prerequisite: AHS 1871.
The role of each therapeutic discipline working within the process of rehabilitation. Topics include medical terminology, ethics, and effects of illness on the patient.
- 2043 Nutrition**
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112 or AHS 2103.
An examination of human nutritional needs from infancy to adulthood.
- 2083 Human Biology: Anatomy**
(3-0) 3 hours credit. Prerequisite: BIO 1103 or consent of instructor.
The structure of human muscular, skeletal, nervous and organ systems.
- 2091 Human Biology: Anatomy Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 2083.
- 2103 Human Biology: Physiology**
(3-0) 3 hours credit. Prerequisite: BIO 1103 or consent of instructor.
Physiological processes in human systems.
- 2111 Human Biology: Physiology Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 2103.
- 2412 Hematology**
(2-0) 2 hours credit. Prerequisite: AHS 1883 or consent of instructor.
Normal and abnormal blood pictures and cell maturations with related clinical analyses, hemoglobinopathies, bone marrows, blood coagulation and all factors.
- 2422 Hematology Laboratory**
(0-6) 2 hours credit.
Must be taken concurrently with AHS 2412. Clinical hematological laboratory.
- 2533 Parasitology and Urinalysis**
(3-0) 3 hours credit. Prerequisite: AHS 1883.
Study of human parasitology, urinalysis with correlation to physiological condition.
- 2542 Parasitology and Urinalysis Laboratory**
(0-6) 2 hours credit.
Must be taken concurrently with AHS 2533. Clinical human parasitology and urinalysis.

- 3002 Principles of Practice**
(2-0) 2 hours credit. Prerequisite: Approval of Occupational Therapy Program Director.
Overview of occupational therapy theory and clinical application.
- 3012 Introductory Pathology**
(2-0) 2 hours credit. Prerequisites: BIO 1103, 1112, or AHS 2103.
Concepts of disease and diagnosis of pathological conditions.
- 3113 Kinesiology**
(3-0) 3 hours credit. Prerequisite: AHS 2083, 2103.
A study of the principles of human motion. Primarily designed for students majoring in physical education.
- 3164 Human Anatomy**
(4-0) 4 hours credit. Prerequisite: Approval of the appropriate Allied Health Program Director.
Lectures and demonstrations on the structure of the human body.
- 3174 Human Anatomy Laboratory**
(0-12) 4 hours credit.
Must be taken concurrently with AHS 3164. Includes prosections, demonstrations and dissections of human material.
- 3201 Physical Therapy: History and Philosophy**
(1-0) 1 hour credit.
The history and philosophy of Physical Therapy. Includes presentations on various aspects of the profession.
- 3212 Occupational Therapy Media I**
(0-6) 2 hours credit. Prerequisite: Consent of instructor.
Woodworking. Use of tools in building adaptive equipment.
- 3223 Occupational Therapy Media II**
(0-9) 3 hours credit. Prerequisite: Consent of instructor.
Ceramic techniques as applied to patient therapy.
- 3302 Physical Therapy Procedures**
(2-0) 2 hours credit. Prerequisite: Consent of the instructor.
Fundamental concepts for basic patient care and management.
- 3463 Human Physiology**
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 2103 or 2203 or consent of instructor.
Physiological processes in human systems.
- 3471 Human Physiology Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with AHS 3463.
- 3752 Dynamics of Motion I**
(2-0) 2 hours credit. Prerequisites: AHS 3164 and approval of the appropriate Allied Health Program Director.
Analysis and evaluation of movement disorders and the use of assistive devices for their prevention and correction.
- 3761 Dynamics of Motion I Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with AHS 3752.
- 3773 Clinical Chemistry**
(3-0) 3 hours credit. Prerequisite: BIO 3513.
Physiological systems in normal and diseased processes and their correlation with clinical chemistry laboratory.
- 3782 Clinical Chemistry Laboratory**
(0-6) 2 hours credit.
Must be taken concurrently with AHS 3773
Analytical clinical chemistry techniques and automated clinical instrumentation with quality controls and blood analyses.

3793 Occupational Therapy Theory I

(3-0) 3 hours credit. Prerequisite: Approval of Occupational Therapy Program Director.

Identification of the life tasks and adaptive skills of the developing human; observation and evaluation procedures used in the occupational therapy process correlated with field observations.

3802 Clinical Medicine I

(2-0) 2 hours credit. Prerequisite: Approval of appropriate Allied Health Program Director.

Analysis of psychiatric theory and clinical application.

3812 Clinical Seminar

(2-0) 2 hours credit.

Analysis of treatment modalities related to clinical treatment.

3862 Immunohematology and Serology

(2-0) 2 hours credit. Prerequisites: AHS 2412, BIO 4743.

Discussion of bloodbanking antigens and antibodies, cross-matching, and clinical serological assays in regard to normal and diseased states.

3872 Immunohematology and Serology Laboratory

(0-6) 2 hours credit.

Must be taken concurrently with AHS 3862. Bloodbanking techniques and serological assays including radio immune assay procedures.

3881 Therapeutic Concepts and Procedures in Physical Therapy

(1-0) 1 hour credit. Prerequisite: Approval of Physical Therapy Program Director.

Theory and application of the use of physical agents in patient treatment.

3892 Therapeutic Concepts Laboratory

(0-6) 2 hours credit.

Must be taken concurrently with AHS 3881.

3902 Occupational Therapy Skills Laboratory I

(0-6) 2 hours credit. Prerequisites: AHS 3793 and approval of Occupational Therapy Program Director.

Identification analysis and adaptation of life tasks and activities related to age-specific needs, capacities and roles.

3922-6 Clinical Field Work Experience — Level I

Variable hours credit. Prerequisite: Approval of appropriate Allied Health Program Director.

Observation and Level I participation in the delivery of health care services.

4003 Clinical Medicine II

(3-0) 3 hours credit. Prerequisites: AHS 3012 and approval of the appropriate Allied Health Program Director.

The study of medical and surgical conditions treated by Physical and Occupational Therapy.

4013 Clinical Medicine III

(3-0) 3 hours credit. Prerequisites: AHS 4003 and approval of the appropriate Allied Health Program Director.

The study of medical and surgical conditions treated by Physical and Occupational Therapy. A continuation of AHS 4003.

4023 Occupational Therapy Skills Laboratory II

(0-9) 3 hours credit. Prerequisite: Approval of the Occupational Therapy Program Director.

Disability evaluations, splinting, adaptive equipment and activities of daily living.

4033 Occupational Therapy Skills Laboratory III

(0-9) 3 hours credit. Prerequisite: Approval of the Occupational Therapy Program Director.

The use and analysis of developmental assessment techniques as related to Occupational Therapy.

- 4043 Occupational Therapy Media III**
(0-9) 3 hours credit. Prerequisite: Approval of the Occupational Therapy Program Director.
Minor crafts as therapeutic modalities.
- 4053 Occupational Therapy Theory II**
(3-0) 3 hours credit. Prerequisite: Approval of the Occupational Therapy Program Director.
The study of physical disabilities as related to treatment modalities.
- 4202 Dynamics of Motion II**
(2-0) 2 hours credit. Prerequisites: AHS 3752 and 3761.
Analysis and evaluation of movement disorders and the use of assistive devices for their prevention and correction. A continuation of AHS 3752.
- 4211 Dynamics of Motion II Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with AHS 4202.
- 4222 Advanced Concepts and Procedures in Physical Therapy**
(2-0) 2 hours credit. Prerequisite: Approval of Physical Therapy Program Director.
Advanced training in developing rehabilitation treatment plans for comprehensive patient care.
- 4231 Advanced Concepts and Procedures in Physical Therapy Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with AHS 4222.
- 4301 Clinical Education**
(0-4) 1 hour credit. Prerequisite: Approval of appropriate Allied Health Program Director.
Supervised training in a clinical setting. May be repeated for a total of 4 hours credit.
- 4313 Therapeutic Exercise I**
(2-6) 3 hours credit. Prerequisites: AHS 4202, 4463. Approval of Physical Therapy Program Director.
Emphasis on exercise techniques that are based on neurosciences and human development patterns.
- 4323 Therapeutic Exercise II**
(2-6) 3 hours credit. Prerequisites: AHS 4313. Approval of Physical Therapy Program Director.
Emphasis on exercise techniques that are based on neurosciences and human development patterns. A continuation of AHS 4313.
- 4413 Mammalian Physiology**
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422 and consent of instructor.
Physiology of mammalian organs and organ systems.
- 4421 Mammalian Physiology Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with AHS 4413.
- 4463 Human Neurosciences**
(3-0) 3 hours credit. Prerequisite: BIO 3413 or AHS 3463.
Structure and function of the human nervous system.
- 4471 Human Neurosciences Laboratory**
(0-3) 1 hour credit.
Must be taken concurrently with AHS 4463.
- 4501 Seminar in Rehabilitation**
(1-0) 1 hour credit. Prerequisite: Approval of appropriate program director.
Presentation and discussion of current scientific literature and/or issues.
- 4783 Pathogenic Microorganisms**
(3-0) 3 hours credit. Prerequisites: BIO 3713, 3722.
A consideration of medically important microorganisms and their interaction with animal and human hosts.

4792 Pathogenic Microorganisms Laboratory

(0-6) 2 hours credit.

Must be taken concurrently with AHS 4783.

4803 Occupational Therapy Theory III

(3-0) 3 hours credit. Prerequisite: Approval of Occupational Therapy Program Director.

Overview of life tasks and adaptive skills of the developing human; treatment planning and professional communications with field observations.

4823 Allied Health Management and Consultation

(3-0) 3 hours credit. Prerequisite: Approval of appropriate Allied Health Program Director.

Planning, organizing, supervising, and implementing occupational therapy services as a line function and as a consultant; legal and ethical considerations.

4843 Advanced Clinical Microbiology

(2-6) 3 hours credit. Prerequisite: Approval of Medical Technology Program Director.

An integrated lecture and laboratory with emphasis on abnormal microbial flora found in diseased humans.

4854 Advanced Clinical Chemistry

(2-9) 4 hours credit. Prerequisite: Approval of Medical Technology Program Director.

An integrated lecture and laboratory with emphasis on special clinical chemistries, toxicology, and clinical chemistry of abnormal or diseased states.

4863 Advanced Clinical Hematology

(2-6) 3 hours credit. Prerequisite: Approval of Medical Technology Program Director.

An integrated lecture and laboratory with emphasis on blood pictures, bone marrows and hematological findings of diseased states.

4884 Advanced Immunohematology and Serology

(2-9) 4 hours credit. Prerequisite: Approval of Medical Technology Program Director.

An integral lecture and laboratory with emphasis on unusual antibodies and incompatibilities.

4911-3 Independent Study

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

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

4923 Special Project

(2-9) 3 hours credit. Prerequisite: Consent of Program Director.

An intensive supervised student research project.

4942-9 Clinical Field Work Experience — Level II

Variable hours credit. Prerequisites: Approval of appropriate Allied Health Program Director.

In depth experience in and responsibility for the delivery of health care. May be repeated for the required hours of the specific Allied Health degree. When necessary, may be elected for up to 12 hours in a single semester.

DIVISION OF EARTH AND PHYSICAL SCIENCES

BACHELOR OF SCIENCE DEGREE IN APPLIED SCIENCE

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is dependent upon the concentration elected: Applied Geology, 128 semester hours; Applied Physics, 135 semester hours; and Polymer Science, 133 semester hours.⁴⁹

All candidates for the degree must complete the following core of 25 semester hours in the sciences and mathematics:

CHE 1103	Introductory Chemistry
CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis
MAT 1213	Calculus I
MAT 1223	Calculus II
CS 1713	Introduction to Computer Science
PHY 1903	Technical Physics I
PHY 1911	Technical Physics I Laboratory
PHY 1923	Technical Physics II
PHY 1931	Technical Physics II Laboratory

In addition, students must complete a minimum of 53 semester hours selected with approval of the student's Advisor from one of the following Applied Science concentrations:⁵⁰

Applied Geology

A. 47 semester hours in the *major*, 21 of which must be at the upper-division level.

1. 35 semester hours of required courses are:

GEO 1003	Interpreting the Earth
GEO 1011	Interpreting the Earth Laboratory
GEO 1022	Earth History and Stratigraphy
GEO 1031	Earth History and Stratigraphy Laboratory
GEO 3002	Earth Materials I
GEO 3012	Earth Materials I Laboratory
GEO 3022	Earth Materials II
GEO 3031	Earth Materials II Laboratory
GEO 3042	Earth Materials III
GEO 3052	Earth Materials III Laboratory
GEO 3103	Structural Geology: Map and Photo Analysis
GEO 3111	Structural Geology: Map and Photo Analysis Laboratory
GEO 3123	Surface Processes and Sedimentary Geology

⁴⁹Thirty-nine of the total credit hours required for the degree must be at the upper-division level.

⁵⁰For those students who seek an engineering degree, these curricula offer an opportunity to obtain a major part of their engineering training at The University of Texas at San Antonio prior to transfer. UT San Antonio graduates in Applied Science may seek a second bachelor's degree at The University of Texas at Austin in Petroleum, Environmental and Civil Engineering (Applied Geology), Electrical Engineering or Engineering Science (Applied Geology), Electrical Engineering or Engineering Science (Applied Physics) or Chemical Engineering (Polymer Science and Food Technology). For those students who plan to transfer to an engineering curriculum prior to completing the Bachelor of Science in Applied Science Degree, a sequence of courses, tailored to the engineering program of interest, will be recommended by the Advisor.

- GEO 3131 Surface Processes and Sedimentary Geology Laboratory
- GEO 3943 Field Methods in Geology
- GEO 4946 Field Geology

2. 12 additional semester hours of approved *elective* courses in Applied Geology and Applied Science at the upper-division level are required from the following:

- AS 4603 Fundamentals of Hydraulic Engineering
- AS 4911-3 Independent Study
- AS 4923 Special Project
- AS 4931-3 Practicum in Applied Science
- AS 4953 Special Studies in Applied Science
- GEO 2951 Special Interest Topics
- GEO 3142 Economic Geology I: Metals and Industrial Minerals
- GEO 3163 Oceanography
- GEO 3182 Economic Geology II: Fuels
- GEO 3191 Economic Geology II: Fuels — Laboratory
- GEO 4022 Engineering Geology
- GEO 4062 Principles of Environmental Geology
- GEO 4623 Hydrogeology

- B. 6 semester hours of approved *support work* at the upper-division level.

Applied Physics

- A. 54 semester hours in the *major*.

1. 36 semester hours of required courses are:

- AS 3293 Thermodynamics
- AS 4923 Special Project
- AS 4933 Practicum in Applied Science
- PHY 2002 Workshop in Applied Physics
- PHY 2403 Electronics
- PHY 2411 Electronics Laboratory
- PHY 3203 Dynamics
- PHY 3263 Microphysics
- PHY 3313 Materials Physics
- PHY 3321 Materials Physics Laboratory
- PHY 3443 Optics
- PHY 3452 Optics Laboratory
- PHY 4263 Introduction to Quantum Mechanics
- PHY 4403 Electricity and Magnetism

2. 18 additional semester hours of approved *elective* courses in Applied Science⁵¹ at the upper-division level are required to be chosen from either Applied Physics, Applied Geology or Applied Science courses with the consent of the Advisor.

- B. 6 semester hours of required *support work* in mathematics:

- MAT 2213 Calculus III
- MAT 3243 Calculus for Applications

Polymer Science

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

⁵¹With the consent of the student's Advisor, up to 9 hours may be in upper-division Mathematics, Computer Science, Systems Design, Chemistry, or Biology courses.

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APPLIED GEOLOGY

1. 20 semester hours of required courses are:
 - AS 4923 Special Project
 - AS 4933 Practicum in Applied Science
 - PS 3603 Polymer Science I
 - PS 3612 Polymer Science I Laboratory
 - PS 3623 Polymer Science II
 - PS 3632 Polymer Science II Laboratory
 - PS 4653 Polymer Technology
 - PS 4661 Polymer Technology Laboratory
 2. 12 additional semester hours of approved *elective* courses in Applied Science and Polymer Science at the upper-division level to be chosen from the following:
 - PS 3643 Natural and Synthetic Organic Polymers
 - PS 3651 Natural and Synthetic Organic Polymers Laboratory
 - PS 4623 Coatings Technology
 - PS 4703 Organic Chemistry of Coatings
 - PS 4723 Corrosion
 - PS 4743 Industrial and Commercial Applications of Polymers
- B. 26 semester hours of *support work*, 21 of which must be at the upper-division level.
1. 20 semester hours of required courses are:
 - CHE 2203 Organic Chemistry I
 - CHE 2212 Organic Qualitative Analysis
 - CHE 3003 Organic Chemistry II
 - CHE 3012 Organic Quantitative Analysis
 - CHE 3203 Physical Chemistry I
 - CHE 3212 Physical Chemistry Laboratory
 - CHE 3223 Physical Chemistry II
 - CHE 3232 Instrumental Analysis
 2. 6 additional semester hours or approved upper-division course work are required in physical chemistry, organic chemistry, biochemistry, biology, physics, and/or 4000-level polymer science courses.

COURSE DESCRIPTIONS
APPLIED GEOLOGY
(GEO)

1003 Interpreting the Earth

(3-0) 3 hours credit. Concurrent registration for GEO 1011 required; exceptions with consent of instructor.

The Earth as a dynamic planet; relation of Earth's present day processes to its materials, structure and internal constitution. Nature of minerals and rocks, the hydrosphere, tectonics, and surface features of Earth.

1011 Interpreting the Earth Laboratory

(0-2) 1 hour credit. Concurrent registration for GEO 1003 required; exceptions with consent of instructor.

Relation of Earth's present day processes to its materials, structure and internal constitution. Field trips and laboratory study of minerals, rocks, maps and air and satellite photos.

1022 Earth History and Stratigraphy

(2-0) 2 hours credit. Prerequisites: GEO 1003 and 1011. Concurrent registration for GEO 1031 required; exceptions with consent of instructor.

Formation and evolution of the Earth, its life forms, and the major features of its surface.

1031 Earth History and Stratigraphy Laboratory

(0-3) 1 hour credit. Prerequisites: GEO 1003 and 1011. Concurrent registration for GEO 1022 required; exceptions with consent of instructor.

Laboratory study of fossils and rock sequences; interpretation of Earth history.

2951-3 Special Interest Topics

1-3 hours credit.

Special interest geology courses including topics such as geology of Texas, volcanoes and their activity, crystals and gems, geology of Mexico and Central America, and geological investigation of the moon and planets. May be repeated for credit when the topics vary to a maximum of six hours.

3002 Earth Materials I

(2-0) 2 hours credit. Concurrent registration for GEO 3012 required; exceptions with consent of instructor.

Crystallography, chemistry, physical properties and origin of minerals.

3012 Earth Materials I Laboratory

(0-4) 2 hours credit. Concurrent registration for GEO 3002 required; exceptions with consent of instructor.

Laboratory study of crystal models, crystals and minerals.

3022 Earth Materials II

(2-0) 2 hours credit. Prerequisites: GEO 3002 and 3012. Concurrent registration for GEO 3031 required; exceptions with consent of instructor. Principles and methods of optical crystallography.

3031 Earth Materials II Laboratory

(0-3) 1 hour credit. Prerequisites: GEO 3002 and 3012. Concurrent registration for GEO 3022 required; exceptions with consent of instructor.

Use of the petrographic microscope for the identification of minerals in immersion liquids and in thin sections.

3042 Earth Materials III

(2-0) 2 hours credit. Prerequisites: GEO 3022 and 3031. Concurrent registration for GEO 3052 required; exceptions with consent of instructor. Description, occurrence and origin of igneous, metamorphic and sedimentary rocks.

3052 Earth Materials III Laboratory

(0-4) 2 hours credit. Prerequisites: GEO 3022 and 3031. Concurrent registration for GEO 3042 required; exceptions with consent of instructor.

Laboratory study of rocks in hand specimen and thin section.

3103 Structural Geology: Map and Photo Analysis

(3-0) 3 hours credit. Prerequisites: GEO 1003 and 1011. Concurrent registration for GEO 3111 required; exceptions with the consent of instructor.

Response of earth materials to natural stresses. Description and origin of rock structures.

3111 Structural Geology: Map and Photo Analysis Laboratory

(0-2) 1 hour credit. Prerequisites: GEO 1003 and 1011. Concurrent registration for GEO 3103 required; exceptions with consent of instructor.

Laboratory study of structural interpretation using maps, cross-sections, air photos, and descriptive geometric and stereographic methods.

3123 Surface Processes and Sedimentary Geology

(3-0) 3 hours credit. Prerequisites: GEO 3022 and 3031. Concurrent registration for GEO 3131 required; exceptions with consent of instructor.

Processes of erosion, transportation and deposition that transform the surface of the continents and form bodies of sedimentary rock and their primary structures.

3131 Surface Processes and Sedimentary Geology Laboratory

(0-3) 1 hour credit. Prerequisites: GEO 3022 and 3031. Concurrent registration for GEO 3123 required; exceptions with consent of instructor.

Field trips and laboratory studies of sedimentary processes and their products.

3142 Economic Geology I: Metals and Industrial Minerals

(2-0) 2 hours credit. Prerequisites: GEO 1003 and 1011.

Ore and industrial mineral genesis. Description and distribution of the major mineral deposits.

3163 Oceanography

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

General oceanography, with emphasis on marine geology and especially the continental margins.

3182 Economic Geology II: Fuels

(2-0) 2 hours credit. Prerequisites: GEO 1003, 1011, 1022, and 1031. Concurrent registration for GEO 3191 required; exceptions with consent of instructor.

Geology of petroleum, natural gas, coal, uranium; geothermal energy sources.

3191 Economic Geology II: Fuels Laboratory

(0-3) 1 hour credit. Prerequisites: GEO 1003, 1011, 1022, and 1031. Concurrent registration for GEO 3182 required; exceptions with consent of instructor.

Laboratory studies of samples, maps and logs. Preparation of sample logs and sub-surface maps.

3943 Field Methods in Geology

(0-9) 3 hours credit. Prerequisites: GEO 1003 and 1011 and consent of instructor.

Use of surveying methods and topographic and air photo bases for geologic mapping. Description, recording, and interpretation of field relationships.

4022 Engineering Geology

(2-0) 2 hours credit. Prerequisites: GEO 1003 and 1011 and consent of instructor.

Geologic factors in the construction of large structures and excavations. Physical properties of natural minerals. Case studies.

4062 Principles of Environmental Geology

(2-0) 2 hours credit. Prerequisites: GEO 1003 and 1011 and consent of instructor.

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

4623 Hydrogeology

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

Hydrologic cycle and the theory of underground water. Recharge and discharge of aquifers; water quality; exploration and development of groundwater supplies.

4946 Field Geology

(0-17) 6 hours credit. Prerequisite: Consent of instructor.

Field mapping and measurements during a six-weeks period in summer.

COURSE DESCRIPTIONS

APPLIED PHYSICS (PHY)

1703 Energy and the Environment

(3-0) 3 hours credit.

The topics considered, and some of their inter-relations, are: the automobile and mass transportation, common sources of energy, electrical power generation, nuclear, solar and geothermal energy, communications, air, water and noise pollution. Use of mathematics is limited.

1803 Physics for Life Sciences I

(3-0) 3 hours credit. Prerequisite: Working knowledge of high school algebra. PHY 1811 should be taken concurrently.

The principles of physics with applications and problem solving useful to biology and pre-medical students. Topics are mechanics and wave phenomena.

1811 Physics for Life Sciences I Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment in PHY 1803. Laboratory to accompany PHY 1803.

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1823 Physics for Life Sciences II

(3-0) 3 hours credit. Prerequisite: PHY 1803. PHY 1831 should be taken concurrently.

The principles of physics with applications and problem solving useful to biology and pre-medical students. Topics are electricity and magnetism, optics and modern physics.

1831 Physics for Life Sciences II Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment in PHY 1823. Laboratory to accompany PHY 1823.

1903 Technical Physics I

(3-0) 3 hours credit. Prerequisite or concurrent enrollment in MAT 1213 and concurrent enrollment in PHY 1911.

The basic concepts and methods of physics. Topics are mechanics, wave phenomena, and heat.

1911 Technical Physics I Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment in PHY 1903. Laboratory to accompany PHY 1903.

1923 Technical Physics II

(3-0) 3 hours credit. Prerequisites: PHY 1903 and MAT 1223. The latter may be taken concurrently.

A continuation of PHY 1903. Topics covered are electricity and magnetism, optics and an introduction to modern physics.

1931 Technical Physics II Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment in PHY 1923. Laboratory to accompany PHY 1923.

2002 Workshop in Applied Physics

(1-3) 2 hours credit. Prerequisite: PHY 1923.

Development of skills in Applied Physics. Problem solving methods. Fundamentals of experimental techniques.

2223 Musical Acoustics

(3-0) 3 hours credit. 1 yr. Music Theory desirable.

Topics include sound vibration and transmission, interference, resonance, combinatorial tones, string and wind instruments and architectural acoustics.

2403 Electronics

(3-0) 3 hours credit. Prerequisite: PHY 1923. PHY 2411 should be taken concurrently.

Introduction to DC and AC circuits, electric components and their uses in basic circuits for instrumentation.

2411 Electronics Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 2403.

Laboratory to accompany PHY 2403. Construction and testing of electronic circuits and devices.

3203 Dynamics

(3-0) 3 hours credit. Prerequisite: PHY 1923. Prerequisite or concurrent enrollment: MAT 2213

Kinematics and dynamics of systems of particles, rigid body motion. Applications are emphasized.

3263 Microphysics

(3-0) 3 hours credit. Prerequisite: PHY 1923. Prerequisite or concurrent enrollment: MAT 2213

Atomic, molecular, nuclear, and solid-state physics; basic concepts, principles and applications.

3293 Statistical Mechanics

(3-0) 3 hours credit. Prerequisites: PHY 1923 and AS 3293.

Statistical methods. Molecular models of macro systems distributions, fermi and base statistics, fluctuations, applications to materials.

3313 Materials Physics

(3-0) 3 hours credit. Prerequisite: PHY 1923

Mechanical, electrical, thermal and optical properties of solid state materials, crystalline structures, lattice vibrations, electron theory.

3321 Materials Physics Laboratory

(0-3) 1 hour credit. Prerequisite: PHY 1923. Corequisite: PHY 3313.

Determinations and methods of evaluating the properties of materials.

3363 Biophysics

(3-0) 3 hours credit. Prerequisites: CHE 2003, PHY 1923 or PHY 1823, and MAT 1223.

Study of biological systems from the physicist's point of view. Topics are: introduction to atomic structure, molecular bonds, concepts of molecular biophysics, macromolecules, survey of physical experimental techniques in molecular biophysics.

3373 Biomaterials

(3-0) 3 hours credit. Prerequisite: PHY 3363.

Study of biological systems from a physicist's point of view. Topics are: molecular transformations and methods of regulation, macroscopic biostructures and their physical properties, thermodynamics of living systems, interaction of radiation with biological materials.

3383 General Geophysics

(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, PHY 1923 and consent of instructor.

Geomagnetism, gravity, seismology, and heat flow. Interior of the earth and tectonics.

3443 Optics

(3-0) 3 hours credit. Prerequisites: MAT 2213 and an upper-division Physics lecture course. PHY 3452 should be taken concurrently.

Wave motion and its applications primarily in physical optics. Optical correlation techniques, lasers, holography, fiber optics, magneto- and electro-optical phenomena and their applications.

3452 Optics Laboratory

(0-6) 2 hours credit. Prerequisite or concurrent enrollment: PHY 3443.

Measurement of physical optical phenomena, laser techniques, scattering and diffraction.

3953 Electronics for Scientists

(2-3) 3 hours credit. Prerequisite: one year of college Physics.

A one semester course primarily for chemistry, biology and psychology majors. Topics covered will include amplifiers, receivers, transducers, analog and digital circuitry, and principles of simple instruments. This course may not be applied to a major in Applied Physics or Engineering Science.

4103 Classical Concepts in Physics

(3-0) 3 hours credit. Prerequisite: Upper-division standing.

Framework of mechanics, thermodynamics and electromagnetism studied with attention to historical and philosophical aspects. Some applications are considered.

4223 Acoustics

(3-0) 3 hours credit. Prerequisites: PHY 1923 and MAT 2213. PHY 4231 should be taken concurrently.

Applications of infrasound and ultrasound, including sonar and biomedical applications. Noise suppression methods.

4231 Acoustics Laboratory

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

Generation and measurement of acoustical signals.

4263 Introduction to Quantum Mechanics

(3-0) 3 hours credit. Prerequisites: PHY 3203 and MAT 3243.

Schrodinger equation, Matrix methods, interactions of atoms with radiation, Dirac equation, applications to materials.

4303 Advanced Materials Physics

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

Advanced studies in the bulk and surface properties of materials. Special aspects of crystalline and amorphous solids.

4382 Exploration Geophysics

(2-0) 2 hours credit. Prerequisite: GEO 4373. Concurrent registration for AS 4391 required; exceptions with consent of instructor.

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

4391 Exploration Geophysics — Laboratory

(0-2) 1 hour credit. Prerequisite: GEO 4373. Concurrent registration for PHY 4382 required; exceptions with consent of instructor.

Planning and execution of exploration programs and interpretation of the results of magnetic, gravity and seismic surveying.

4403 Electricity and Magnetism

(3-0) 3 hours credit. Prerequisite: PHY 1923. Prerequisite or concurrent enrollment: MAT 3243.

Theory and applications of electrostatics, currents, electromagnetic fields. Maxwell's equations.

COURSE DESCRIPTIONS APPLIED SCIENCE (AS)

1102 Introduction to Engineering

(2-0) 2 hours credit.

Introduction to engineering as a career. Case studies are used to illustrate the scope and nature of the professional activities of engineers. Alternative approaches to engineering problem solving and design by use of engineering principles and modern developments are considered.

1802 Engineering Graphics

(1-3) 2 hours credit.

Freehand and instrument drawing; shape and size description; pictorial methods; freehand lettering; charts and graphs.

2003 Photographic Processes

(3-0) 3 hours credit.

A non-mathematical study designed for the non-scientist of the basic concepts of optics, light, color, and the chemical processes involved in photography. Picture-taking, development, and printing will be demonstrated through a hands-on approach.

2203 Statics

(3-0) 3 hours credit. Prerequisites: PHY 1903 and MAT 1223.

Vector algebra, force systems, free body diagrams. Engineering applications of equilibrium, centroids, moments of inertia.

3213 Mechanics of Solids

(3-0) 3 hours credit. Prerequisites: AS 2203 and CHE 2003.

Internal forces and deformations in solids; stress; strain in elastic and plastic solids; application to simple engineering problems.

3293 Thermodynamics

(3-0) 3 hours credit. Prerequisites: PHY 1923, CHE 2003, and MAT 2213.

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

3333 Engineering Materials

(3-0) 3 hours credit. Prerequisite: AS 3213.

Mechanical and physical properties of engineering materials; atomic structure, crystal structure, microstructure, equilibrium and non-equilibrium states; solidification; heat treatment; principles of materials selection.

3403 Electronic Systems Design

(3-0) 3 hours credit. Prerequisite: PHY 2403; AS 3411 should be taken concurrently.

Design of linear amplifiers, power supplies and other basic electronic instrumentation in common use.

3411 Electronic Systems Design Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS 3403. Laboratory to accompany AS 3403. Design and fabrication of basic electronic systems.

3503 Alternative Energy Sources

(3-0) 3 hours credit. Prerequisites: PHY 1923 and CHE 2003.

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

3663 Fluid Mechanics

(3-0) 3 hours credit. Prerequisites: AS 2203 and MAT 1223.

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

4483 Electromagnetic Radiation

(3-0) 3 hours credit. Prerequisite: PHY 4403.

Maxwell's equations, electromagnetic waves, interaction of electromagnetic radiation with matter, such as in reflection and refraction, waveguides and scattering of plane waves.

4491 Electromagnetic Radiation Laboratory

(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS 4483. Experimentation with reflection, refraction and scattering of electromagnetic waves; design of communications systems.

4603 Fundamentals of Hydraulic Engineering

(3-0) 3 hours credit. Prerequisite: AS 3603 or consent of instructor. The examination of various components of the hydrologic cycle in the atmosphere and outer crust of the Earth. Emphasis is placed on surface waters through analysis of hydrologic data relating to rainfall, runoff, infiltration and evaporation.

4612 Hydraulic Engineering Laboratory

(0-6) 2 hours credit. Prerequisite or concurrent enrollment: AS 4603 or consent of instructor.

Laboratory studies in static and dynamic fluid properties and phenomena.

4633 Water and Wastewater Treatment

(3-0) 3 hours credit. Prerequisites: CHE 2003 and AS 3603 or consent of the instructor.

The application of chemical, biochemical, physical and mathematical processes to water treatment, wastewater treatment and pollution control.

4911-3 Independent Study

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

4923 Special Project

3 hours credit. Prerequisite: Consent of Division Director.

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

4931-3 Practicum in Applied Science

1-3 hours credit. Prerequisite: Consent of Division Director.

A program of research and/or supervised applications of theory in a research, industrial or government environment.

4953 Special Studies in Applied Science

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

An organized course offering specialized study not normally or not often available

as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours within any one discipline will apply to a bachelor's degree.

COURSE DESCRIPTIONS

POLYMER SCIENCE (PS)

3603 Polymer Science I

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

Basic principles of polymer science; kinetics and mechanisms of polymerization and copolymerizations; methods of polymerization; molecular weight determinations and characterization of polymers; solution properties, polymer reactions, cross-linking, graft and block copolymerizations; polymer degradation and stabilization.

3612 Polymer Science I Laboratory

(0-6) 2 hours credit. Prerequisite: PS 3603 or concurrent registration. Laboratory projects illustrating and extending the concepts discussed in PS 3603.

3623 Polymer Science II

(3-0) 3 hours credit. Prerequisite: PS 3603.

Structural and physical aspects of polymers; molecular basis for polymer properties and behavior; the rubbery, glassy and crystalline states; viscoelectricity and rubber elasticity; glass transition; structure, morphology, mechanical, optical and electrical properties.

3632 Polymer Science II Laboratory

(0-6) 2 hours credit. Prerequisite: PS 3623 or concurrent registration.

Laboratory projects illustrating and extending the concepts discussed in PS 3623.

3643 Natural and Synthetic Organic Polymers

(3-0) 3 hours credit. Prerequisites: PS 3623 and CHE 3003.

Preparation, structure and properties of addition and condensation polymers; polymerization by ring opening; block and graft polymers. Structure and properties of cellulose, proteins, rubber and their derivatives.

3651 Natural and Synthetic Organic Polymers Laboratory

(0-3) 1 hour credit. Prerequisite: PS 3643 or concurrent registration.

Laboratory projects illustrating and extending the concepts discussed in PS 3643.

4623 Coatings Technology

(3-0) 3 hours credit. Prerequisite: PS 3623.

Convertible and nonconvertible coatings; solvents, plasticizers, lacquers, varnishes, formulation, pigmentation; film properties, chemical resistance, adhesion, hardness, flexibility, abrasion resistance, strength, color, opacity gloss; electrocoating; radiation and photo-curing. Pigmented coatings (dispersion, characteristics, vehicle characteristics, formulation, manufacture, application); extender pigments; decorative paints and industrial finishes; corrosion and chemical resistant paint systems.

4653 Polymer Technology

(3-0) 3 hours credit. Prerequisites: PS 3643 and PS 3651. Finishing of polymers; thermosets; molding powders, laminates; polymer foams; coatings, drying oils, alkyds, epoxy resins, urethanes, natural and synthetic rubber processing; vulcanization and oxidation of polyolefins and polydienes; polymer latices. Film and fiber formation; melt, wet and dry spinning, orientation; adhesion; adhesive systems, polymer-plasticizer interaction, polymer-fiber interactions, reinforced systems, packaging materials.

4661 Polymer Technology Laboratory

(0-3) 1 hour credit. Prerequisite: PS 4653 or concurrent registration. Laboratory projects illustrating and extending the concepts discussed in PS 4653.

4703 Organic Chemistry of Coatings

(3-0) 3 hours credit. Prerequisites: PS 3623 and CHE 3003.

Chemistry of autoxidation, glyceride oils; varnishes; and resins, including alkyd, epoxy, amino and phenol formaldehyde, rubber and silicone resins; acrylic and vinyl coatings; polyurethanes and copolymers. Radiation curing, electrodeposition, photo-curable coatings.

4723 Corrosion

(3-0) 3 hours credit. Prerequisite: PS 3623.

Electrochemical aspects, reaction mechanisms, thermodynamics and kinetics of corrosion processes; prevention of corrosion, cathodic and anodic protection; inhibitors, passivators; coatings.

4743 Industrial and Commercial Applications of Polymers

(3-0) 3 hours credit. Prerequisite: PS 3623.

Mechanical, electrical and thermal properties of engineering plastics; applications as materials of construction; polymers in biology and biomedical engineering; space technology; specialty polymers for high temperature applications, environmental effects on polymers; rain erosion, weathering, corrosive environment, biological environment; radiation effects.

**BACHELOR OF SCIENCE DEGREE
IN CHEMISTRY**

The minimum number of semester hours required for this degree, including the 50 semester hours of General Education Requirements, is 132.⁵² All candidates for the degree must complete:

A. 47 semester hours in Chemistry.

1. 38 semester hours of required courses are:

CHE 1103	Introductory Chemistry
CHE 2003	Chemical Principles
CHE 2012	Inorganic Qualitative and Quantitative Analysis
CHE 2203	Organic Chemistry I
CHE 2212	Organic Qualitative Analysis
CHE 3003	Organic Chemistry II
CHE 3012	Organic Quantitative Analysis
CHE 3203	Physical Chemistry I
CHE 3212	Physical Chemistry Laboratory
CHE 3223	Physical Chemistry II
CHE 3232	Instrumental Analysis
CHE 4243	Organic Chemistry III
CHE 4263	Inorganic Chemistry
CHE 4923	Special Project in Chemistry
CHE 4971	Proseminar

2. 9 additional semester hours of approved *elective* Chemistry at the upper-division level are required.

B. 29 semester hours of *support work* in Science and Mathematics.

1. 20 semester hours of required courses are:

BIO 3513	Biochemistry
CS 1713	Introduction to Computer Science
MAT 1213	Calculus I
MAT 1223	Calculus II
PHY 1903	Technical Physics I
PHY 1911	Technical Physics I Laboratory

⁵²Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

PHY 1923 Technical Physics II
 PHY 1931 Technical Physics II Laboratory

2. 9 additional hours of *elective support work* are required in courses in the College of Sciences and Mathematics, as approved by the Advisor.

MAT 2213 Calculus III or
 CS 1723 Information Structures I

- C. 6 semester hours of *free electives*.

COURSE DESCRIPTIONS

CHEMISTRY (CHE)

1003 General Chemistry for Allied Health Sciences

(3-0) 3 hours credit.

A one semester introduction to atomic structure, chemical bonding, stoichiometry, states of matter, inorganic chemical reactions, acids and bases. This course is designed for majors in physical or occupational therapy, prenursing, and dental hygiene. May not be applied to a major in chemistry, biology, or medical technology.

1103 Introductory Chemistry

(3-0) 3 hours credit.

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

1111 General Chemistry Laboratory for Allied Health Sciences

(0-3) 1 hour credit. Prerequisite or concurrent enrollment in CHE 1003. Introduction to chemical laboratory techniques. This course is designed for majors in physical or occupational therapy, prenursing, and dental hygiene. May not be applied to a major in chemistry, biology, or medical technology.

1122 Introductory Chemistry Laboratory Workshop

(0-6) 2 hours credit. Prerequisite 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.

1153 The Chemistry of Fashion

(3-0) 3 hours credit. May not be applied to a major in chemistry.

A survey of the chemical nature of synthetic fibers, fabrics, scents, dyes, cosmetics, and toiletries.

1173 Alchemy and the Sources of Modern Chemistry

(3-0) 3 hours credit. May not be applied to a major in chemistry.

Scientific content of magic, witchcraft, alchemy, and iatrochemistry. Origins and development of ideas concerning composition and transformations of matter: metallurgy, ceramics and fermentation. Readings will include primary materials selected from Renaissance and modern literary and scientific sources.

2003 Chemical Principles

(3-0) 3 hours credit. Prerequisite: CHE 1103. CHE 1122 is recommended.

Primarily for science majors. Elementary inorganic and physical chemistry: a continuation of descriptive inorganic chemistry, coordination chemistry, solutions and electrolytes, redox processes, elementary thermodynamics, chemical kinetics, and elementary electrochemistry and nuclear chemistry; introduction to organic chemistry.

2012 Inorganic Qualitative and Quantitative Analysis

(0-6) 2 hours credit. Prerequisite: CHE 2003 or concurrent registration.

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

2103 Elementary Organic and Biochemistry

(3-0) 3 hours credit. Prerequisites: CHE 1003 and CHE 1111.

May not be applied to a major in chemistry. A one semester survey of the structures and reactions of some important functional groups of organic Chemistry. The relationship of these functional groups to the chemistry of lipids, carbohydrates, nucleic acids and proteins.

2111 Organic and Biochemistry Laboratory

(0-3) 1 hour credit. Prerequisite: CHE 2103 or concurrent registration.

May not be applied to a major in chemistry. Laboratory examination of the properties of some simple organic and biological chemicals; solubility, crystallization, organic reactions, titration, enzyme action, sugars, vitamins.

2203 Organic Chemistry I

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

An elementary study of structure, reactions, and reaction mechanisms associated with organic compounds, e.g., aliphatic and aromatic hydrocarbons, alcohols, ethers, organic halogen compounds, aldehydes, and ketones.

2212 Organic Qualitative Analysis

(0-6) 2 hours credit. Prerequisite: CHE 2203 or concurrent registration. Primarily for science majors.

Determination of physical constants of organic compounds; separation methods: vacuum distillation, crystallization, column chromatography, and gas chromatography; organic elemental analysis, functional group study and qualitative analysis.

3003 Organic Chemistry II

(3-0) 3 hours credit. Prerequisites: CHE 2203; CHE 2212; or concurrent registration.

Continuing study of fundamentals of structure, stereo-chemistry, reactions and reaction mechanisms of carbonyl compounds and their derivatives; organic compounds containing nitrogen, phosphorus and sulphur; poly-functional organic compounds; including an introduction to biochemistry. A continuation of CHE 2203.

3012 Organic Quantitative Analysis

(0-6) 2 hours credit. Prerequisites: CHE 2212; CHE 3003 or concurrent registration; or consent of instructor.

Continuing laboratory study of quantitative analysis of organic reactions and molecular structure; qualitative and quantitative use of infrared, ultra-violet, and proton nuclear magnetic resonance spectrometry; introduction to mass spectrometry.

3103 Analytical Chemistry

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

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

3193 Physical Chemistry for Life Sciences

(3-0) 3 hours credit. Prerequisites: CHE 2203, BIO 3143, BIO 3421, MAT 1213. May not be applied to a major in chemistry.

Selected topics from physical chemistry with special emphasis on biological systems and applications. Topics covered include thermodynamics, energetics, kinetics, spectroscopy, nuclear chemistry and macromolecules.

3203 Physical Chemistry I

(3-0) 3 hours credit. Prerequisites: CHE 2003, CHE 2012, MAT 1223, PHY 1923, and PHY 1931; at least one semester of organic chemistry is also recommended.

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

3212 Physical Chemistry Laboratory

(0-6) 2 hours credit. Prerequisite: CHE 3203

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

3223 Physical Chemistry II

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

Chemical kinetics, electrolytes and electrochemistry, elements of quantum mechanics, chemical bonds, spectroscopy, and photo-chemistry. A continuation of CHE 3203.

3232 Instrumental Analysis

(0-6) 2 hours credit. Prerequisites: CHE 3012; CHE 3212 and CHE 3223; or concurrent registration.

Electrochemical methods; use of modern spectrometric and chromatographic instrumentation in separation, purification, and/or quantitative characterization of chemical systems.

3252 Chemistry in Industry

(2-0) 2 hours credit. Prerequisites: CHE 3003 and CHE 3203 or concurrent registration, or consent of instructor.

The roles and problems of chemistry and chemists in the chemical industry: laboratory and operations management; basic research and product development; production, quality control, pollution and waste materials control, and safety; advertising, sales, and patents; the governmental/industrial interface; economic considerations, employment practices, and professional societies will also be explored.

3333 Marine Chemistry

(3-0) 3 hours credit. Prerequisites: CHE 3003 and CHE 3203 or concurrent registration; or consent of instructor.

Fundamental concepts of marine chemistry; structure and properties of water; elemental composition of sea water, the carbonate system; marine organic chemistry; a review of marine sediments.

3352 Mineral Analysis

(2-0) 2 hours credit. Prerequisites: CHE 2003, CHE 2012, AS 2002, AS 2012, and concurrent registration for CHE 3361; or consent of instructor.

Theory of x-ray diffraction, spectrographic, and other methods of analysis of earth materials.

3361 Mineral Analysis Laboratory

(0-3) 1 hour credit. Prerequisite: concurrent registration for CHE 3352 or consent of instructor.

Methods and techniques of analyzing earth materials.

3373 Geochemistry

(3-0) 3 hours credit. Prerequisites: CHE 2003 or consent of instructor.

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

3953 Introduction to Research Techniques

(1-6) 3 hours credit. Prerequisites: Upper-division standing and consent of instructor.

Practical introduction to techniques and methodology of chemical research.

4223 Advanced Biochemistry

(3-0) 3 hours credit. Prerequisites: BIO 3513, 3521 and CHE 3003, 3012.

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

4231 Physical Techniques in Biochemistry

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

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

4243 Organic Chemistry III

(3-0) 3 hours credit. Prerequisites: CHE 3003 and CHE 3223; CHE 3203 or consent of instructor.

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

4253 Physical Chemistry III

(3-0) 3 hours credit. Prerequisites: CHE 3003, CHE 3223 and CHE 3232; or consent of instructor.

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

4263 Inorganic Chemistry

(3-0) 3 hours credit. Prerequisites: CHE 3203.

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

4272 Advanced Organic Laboratory

(0-6) 2 hours credit. Prerequisites: CHE 3223, CHE 3232, and concurrent registration in CHE 4243 or consent of the instructor.

Functional group analysis of organic compounds, structure analysis and proof, multi-step synthesis involving functional group modifications, and separation and identification of complex organic mixtures.

4282 Inorganic Preparations

(0-6) 2 hours credit. Prerequisite: CHE 4263 or consent of instructor.

A laboratory study of coordination compounds and inorganic structure.

4293 Nuclear Chemistry and Physics

(3-0) 3 hours credit. Prerequisites: CHE 3203 and 3223.

A study of nuclear reactions, radiation detection and measurement, and chemical applications.

4301 Nuclear Chemistry and Physics Laboratory

(0-3) 1 hour credit. Prerequisite: CHE 4293 or concurrent registration and consent of instructor.

A laboratory study of nuclear reactions, radiation detection and measurement, and chemical applications.

4911-3 Independent Study

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

4923 Special Project in Chemistry

3 hours credit. Prerequisite: Consent of Division Director.

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

4931-3 Internship in Applied Chemical Operations

1-3 hours credit. Prerequisites: CHE 3252, CHE 3012, and CHE 3232 or concurrent registration; and consent of Division Director.

Practical introduction to industrial and/or similar applied chemistry operations, via supervised extracollegiate internship, resulting in a report.

4953 Special Studies in Chemistry

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

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

4971 Proseminar

(1-0) 1 hour credit. Prerequisites: CHE 3003 and CHE 3203.

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

COURSE DESCRIPTIONS
ASTRONOMY
(AST)

1013 Introduction to Astronomy I

(3-0) 3 hours credit.

A descriptive course including the development of astronomy, and its methods, the motions, laws and evolution of the solar system. Occasional evening viewing sessions are held.

1023 Introduction to Astronomy II

(3-0) 3 hours credit. Prerequisite: AST 1013 or consent of instructor.

The general properties and types of stars, unusual stellar objects such as quasars and black holes, galaxies, evolution and cosmology.

Occasional evening viewing sessions are held.

1031 Introduction to Astronomy Laboratory

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

Exercises in the use of the telescope and certain other astronomical instruments to include simple observations, measurement and photography. This course, though optional, is of most value when taken concurrently with AST 1023.

DIVISION OF MATHEMATICS, COMPUTER SCIENCE, AND SYSTEMS DESIGN

The division offers a Bachelor of Science Degree in Mathematics designed for students interested in obtaining a secondary teaching certificate. It also offers a Bachelor of Science Degree in Mathematics, Computer Science, and Systems Design in which the student's work is concentrated in the areas of mathematics, applied mathematics, statistics, computer science, systems science, process control, actuarial science, or any combination thereof.

BACHELOR OF SCIENCE DEGREE IN MATHEMATICS

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 126.⁵³

All candidates for the degree must complete:

A. 30 required semester hours listed below:

MAT	1213	Calculus I ⁵⁴
MAT	1223	Calculus II
MAT	2213	Calculus III
MAT	3513	Probability and Statistics
MAT	3523	Statistical Methods
CS	1713	Introduction to Computer Science
CS	1723	Information Structures I
MAT	3213	Foundations of Analysis
MAT	3233	Modern Algebra
MAT	4263	Geometry

B. In addition to the required courses, students must take 9 credits of upper division math electives. It is recommended that students select either MAT 4233 and MAT 4243 Modern Abstract Algebra I and II or MAT 4213 and MAT 4223 Real Analysis I and II as 6 of their 9 elective credits.

C. 37 semester hours of free electives chosen to satisfy the Teacher Certification Requirements.

BACHELOR OF SCIENCE DEGREE IN MATHEMATICS, COMPUTER SCIENCE, AND SYSTEMS DESIGN

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 126.⁵⁵

All candidates for the degree must complete:

A. 47 semester hours in the *major*, in addition to the 4 hours of General Education Requirements in Mathematics of which 27 must be at the upper-division level.⁵⁶

⁵³Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

⁵⁴The student who is not prepared to begin MAT 1213 must take MAT 1011, Algebra or MAT 1183, College Algebra and/or MAT 1092, Elementary Functions.

⁵⁵Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

⁵⁶The student who is not prepared to begin MAT 1213 must take MAT 1011, Algebra or MAT 1183, College Algebra and/or MAT 1092, Elementary Functions.

1. 21 semester hours of required courses are:

MAT	1213	Calculus I
MAT	1223	Calculus II
MAT	2213	Calculus III
MAT	3513	Probability and Statistics
MAT	3523	Statistical Methods
CS	1713	Introduction to Computer Science
CS	1723	Information Structures I

2. 26 additional semester hours of electives are required in the *major*, 21 of which must be at the upper-division level and none may be selected from courses numbered between 1000 and 1999.

B. 29 semester hours of *free electives*.

COURSE DESCRIPTIONS

MATHEMATICS (MAT)

1011 Algebra

(1-0) 1 hour credit.

Aspects of college algebra. Includes: exponents, arithmetic and factorization of polynomials; rational expressions; negative and rational exponents; scientific notation; radicals solving linear and quadratic equations; linear inequalities; absolute values; Cartesian coordinates, distance formula, linear equations; relations; functions, graphing functions. Credit cannot be earned for both MAT 1011 and MAT 1083.

1022 Fundamentals of Calculus

(2-0) 2 hours credit. Prerequisite: MAT 1011 or MAT 1183.

Derivatives of functions and their interpretations; formulas for derivatives; curve sketching using derivatives; maximum and minimum problems; exponentials and logarithmic functions and their derivatives; implicit differentiation; partial derivatives and application; anti-derivatives; indefinite integrals; integration formulas; definite integrals and application.

1031 Applied Linear Algebra

(1-0) 1 hour credit. Prerequisite: MAT 1011 or MAT 1183.

Systems of linear equations, solution by elimination; systems of linear inequalities; introduction to linear programming, vectors and matrices, determinants, inverses of matrices, applications.

1051 Probability and Finite Math

(1-0) 1 hour credit. Prerequisite: MAT 1011 or MAT 1183.

Events; sample spaces, partitioning the sample space; probability functions; probabilities of events; calculating probabilities, conditional probabilities and independent events; relative frequency interpretation of probability.

1062 Statistics

(2-0) 2 hours credit. Prerequisite: MAT 1051.

Relative frequency interpretation of probability and related notions such as distribution functions; random variables; expected values; descriptive statistics; some common distributions; the binomial, Poisson, normal and sampling distributions from the normal; interval estimates; tests of hypotheses.

1092 Elementary Functions

(2-0) 2 hours credit. Prerequisite: MAT 1011 or the equivalent. Polynomial and rational functions, exponential functions, logarithmic functions, trigonometric functions, functions of several variables.

1103 Consumer Mathematics

(3-0) 3 hours credit.

A course designed to give the necessary mathematical tools for coping with mod-

ern technological society. Topics include linear equations and inequalities, ratios, proportion and variation, mathematics of finance.

1112 Mathematics for Elementary Education Majors I

(2-0) 2 hours credit. Prerequisite: Must have a declared major of Elementary Education.

Sets, positive integers and zero, mathematical systems, negative integers, rational numbers, irrational numbers.

1122 Mathematics for Elementary Education Majors II

(2-0) 2 hours credit. Prerequisites: MAT 1112 and must have a declared major of Elementary Education.

The real and complex number systems.

1183 College Algebra

(3-0) 3 hours credit.

The same topics as in MAT 1011 are covered but in more depth. Credit cannot be earned for both MAT 1011 and MAT 1183.

1203 Problems in Calculus I

(3-0) 3 hours credit. Must be taken concurrently with MAT 1213.

A calculus recitation with emphasis on problem solving.

1213 Calculus I

(3-0) 3 hours credit. Prerequisites: MAT 1011 or MAT 1183 and MAT 1092 or the equivalents.

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.

1223 Calculus II

(3-0) 3 hours credit. Prerequisite: MAT 1213.

The Riemann integral and the fundamental theorem of calculus. Transcendental functions, methods of integration and applications of the integral.

1233 Problems in Calculus II

(3-0) 3 hours credit. Must be taken concurrently with MAT 1223.

A calculus recitation with emphasis on problem solving.

2013 Statistical Methods for the Life and Social Sciences

(3-0) 3 hours credit. Prerequisite: MAT 1062 or consent of instructor.

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

2213 Calculus III

(3-0) 3 hours credit. Prerequisite: MAT 1223.

Topics in differential and integral calculus. Taylor series, power series, convergence tests, vectors, functions of several variables, partial derivatives, multiple integrals.

2233 Matrix 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.

3013 Multivariate Analysis for the Life and Social Sciences

(3-0) 3 hours credit. Prerequisite: MAT 2013 or MAT 3513.

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

3113 Algebra for Elementary Teachers

(3-0) 3 hours credit. Prerequisite: MAT 1122 and must have a declared major of Elementary Education.

Linear equations, quadratic equations, systems of equations, and inequalities.

3123 Geometry for Elementary Teachers

(3-0) 3 hours credit. Prerequisite: MAT 1122 and must have a declared major of Elementary Education.

The nature of geometry from an intuitive and from a formal point of view, with applications. Topics include: congruence, measurement, parallelism, similarity.

3131 Functions and Limits

(1-0) 1 hour credit. Prerequisite: MAT 1011.

An in-depth study of mathematical functions incorporating the concept of the limit of a function.

3213 Foundations of Analysis

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

A rigorous development of the foundations of real analysis; basic point set topology; limits; continuity. Emphasis on theorem proving and mathematical rigor.

3223 Complex Variables

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

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

3233 Modern Algebra

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

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

3243 Calculus for Applications

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

Topics include: line integrals, Green's theorem, Stokes' theorem, Fourier series, Laplace transforms.

3513 Probability and Statistics

(3-0) 3 hours credit. Prerequisite or corequisite: MAT 2213. MAT 2013 recommended but not required.

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

3523 Statistical Methods

(3-0) 3 hours credit. Prerequisites: MAT 3513 and CS 1713.

Methodology of applied statistics; tests for randomness and independence, simple and compound tests of hypotheses, confidence interval and point estimation, simple linear models.

3613 Differential Equations I

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

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

3623 Differential Equations II

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

Continuation of MAT 3613. Topics include stability, partial differential equations and boundary value problems.

3633 Numerical Analysis I

(3-0) 3 hours credit. Prerequisites: MAT 2213 and CS 1713.

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

3643 Numerical Analysis II

(3-0) 3 hours credit. Prerequisite: MAT 3633.

Numerical solution of ordinary and partial differential equations.

3923 Finance Mathematics

(3-0) 3 hours credit. Prerequisite: MAT 1011 or MAT 1022.

This course will cover an analysis of the time value of money and will serve as preparation for parts of the actuarial examinations. Topics include determining the evaluation of flows of money, mortgage payments, bond amortization schedules, annuities, and related areas.

- 3933 Mathematics of Insurance**
(3-0) 3 hours credit. Prerequisite: MAT 3513.
Probability theory applied to problems involving life and death, costs of life assurances, life annuities, pension, reserves.
- 4112 Mathematical Topics for Elementary Teachers**
(2-0) 2 hours credit. This course cannot be applied to the major in Mathematics, Computer Science, and Systems Design. Selected mathematical topics of an advanced nature relevant to the modern elementary mathematics curriculum.
- 4123 History of Mathematics**
(3-0) 3 hours credit.
A survey of mathematical explorations developed through selected historical issues and biographies.
- 4213 Real Analysis I**
(3-0) 3 hours credit. Prerequisite: MAT 3213.
An in-depth study of the calculus of functions of several variables. Topics include: the Bernstein Polynomial Theorem, Stone-Weierstrass Theorem and the derivative in $\mathbb{R}$.
- 4223 Real Analysis II**
(3-0) 3 hours credit. Prerequisite: MAT 4213.
The Riemann-Stieltjes integral and related topics, which include: the bounded convergence theorem, the Riesz representation theorem and the main theorems of integral calculus in $\mathbb{R}$ and $\mathbb{R}^n$.
- 4233 Modern Abstract Algebra I**
(3-0) 3 hours credit. Prerequisite: MAT 2213. MAT 3233 recommended.
An indepth study of groups and rings.
- 4243 Modern Abstract Algebra II**
(3-0) 3 hours credit. Prerequisite: MAT 4233.
Topics in field theory and vector spaces.
- 4253 Number Theory**
(3-0) 3 hours credit. Prerequisites: MAT 2213.
The theory of primes, congruences and related topics.
- 4263 Geometry**
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Topics in projective, affine and non-Euclidean geometry.
- 4273 Topology**
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Set theory including cardinal and ordinal numbers. Topological properties of the real line and metric spaces.
- 4513 Introduction to Sample Survey Theory and Methods**
(3-0) 3 hours credit. Prerequisite: MAT 3513.
Basic tools, simple random sampling, stratified random sampling, ratio and regression estimates, systematic sampling, cluster sampling, unequal probability sampling, two-stage and multistage sampling, non-sampling errors.
- 4523 Analysis of Variance and Design of Experiments**
(3-0) 3 hours credit. Prerequisite: MAT 3513.
This course consists of a study of general concepts in the design and analysis of experiments. The following notions will be examined: response variable, factors to be varied, quantitative and qualitative factors, fixed and random factors and how the factors are to be combined. Also to be studied are the method of randomization to be used in the design, the order of experimentation, the mathematical model used to describe the experiment, computation of the test statistics and the interpretation of the results.
- 4533 Applied Non-Parametric Statistics**
(3-0) 3 hours credit. Prerequisite: MAT 2013 or MAT 3513 or consent of instructor.
Tests of location. Goodness of fit tests. Rank tests. Tests based on nominal and ordinal data for both related and independent samples. Measures of association.

4543 Introduction to Stochastic Processes

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

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

4553 Introduction to Multivariate-Statistical Analysis

(3-0) 3 hours credit. Prerequisites: MAT 3513 and MAT 2233.

Introduction to the theory and methodology of multivariate statistics.

4563 Theory of Reliability and Life Testing

(3-0) 3 hours credit. Corequisite: MAT 3513.

Structural reliability, failure data analysis, point estimates and interval estimates for the reliability of components, sampling plans for failure data, maintenance policies, models for reliability growth.

4573 Applied Regression Analysis

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

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

4911-3 Independent Study

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

4953 Special Studies in Mathematics

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

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

COURSE DESCRIPTIONS COMPUTER SCIENCE (CS)

1043 Introductory Computer Programming for Business Applications

(2-2) 3 hours credit. Prerequisite: MAT 1011 or MAT 1183.

Introductory programming. Sorting and ranking; plotting; inventory control.

1073 Introductory Computer Programming for Scientific Applications

(2-2) 3 hours credit. Prerequisite: MAT 1011 or MAT 1183.

Introductory programming. Sorting and ranking; plotting; numerical taxonomy. Solution of non-linear equations; linear regression. Solution of linear systems.

1133 Computer Literacy

(3-0) 3 hours credit.

A survey of Computer Science designed to give a general understanding of the computer, its uses and social impact. This course is designed for students not wishing to major in Mathematics, Computer Science, and Systems Design.

1713 Introduction to Computer Science

(2-2) 3 hours credit. Prerequisite: MAT 1011 or MAT 1183.

Introduction to basic concepts of computer science including algorithmic processes, functional design of computers, and data representation. Both numerical and non-numerical algorithms are discussed.

1723 Information Structures I

(2-2) 3 hours credit. Prerequisite: CS 1713.

Theory and application of single-cell and elementary multi-dimensional data structures; review of set theory and introduction to boolean algebra, the propositional calculus, and list processing.

2003 Data Analysis

(3-0) 3 hours credit. Prerequisite: MAT 1011 or MAT 1183.

Open to students from all disciplines. Emphasis on familiarization with numerical data, student computer interaction, and visual display of data. Data analysis techniques including: stem and leaf plotting, box plotting, fitting lines and frequencies to medians, transformations to linearity.

2734 Computer Organization and Programming Systems

(3-2) 4 hours credit. Prerequisite: CS 1723.

Representation of programs, instructions, and data in modern computers, and the basic organization of computer systems.

2743 Information Structures II

(3-0) 3 hours credit. Prerequisite: CS 1723.

Theory and application of lists, trees, and graphs.

3013 Problem Solving Using COBOL

(3-0) 3 hours credit. Prerequisite: CS 1713.

Instruction in programming methodology using COBOL. Features of COBOL including editing, report generation, sorting, searching, and file manipulation are emphasized.

3023 Problem Solving Using FORTRAN

(3-0) 3 hours credit. Prerequisite: CS 1713.

Instruction in programming methodology using FORTRAN. Advanced language features and design techniques are emphasized.

3713 Analysis of Algorithms

(3-0) 3 hours credit. Prerequisite: CS 2743.

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

3723 Programming Languages

(3-0) 3 hours credit. Prerequisite: CS 2743.

Study of the concepts and features of programming languages, with examples drawn from procedure-oriented, list-processing, string-manipulation, business-processing, and simulation programming languages.

3773 Programming Methodology

(3-0) 3 hours credit. Prerequisite: CS 2743.

Discussion of modular (structured) programming methods, programming style and program verification techniques.

3783 Data Base Management Techniques

(3-0) 3 hours credit. Prerequisite: CS 1723.

Discussion of file structures, random access devices, file creation, file maintenance, interface languages, and data base management systems.

3793 Introduction to Artificial Intelligence

(3-0) 3 hours credit. Prerequisite: CS 2743.

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

4103 Computers and Mathematics Curricula

(3-0) 3 hours credit. This course cannot be applied to a major in Mathematics, Computer Science, and Systems Design.

This course, for teachers of mathematics, will focus attention on the various computer-oriented curricula, hardware and software for educators, and economic considerations for equipment acquisition.

4163 Computer Concepts for Educators, Administrators, and Managers

(3-0) 3 hours credit. This course cannot be applied to a major in Mathematics, Computer Science, and Systems Design.

A non-technical course emphasizing the total environment of human-computer interaction and the general educational value of learning to program and work with computers.

4713 Compiler Design

(3-0) 3 hours credit. Prerequisite: CS 3723 and CS 2734.

Study of techniques used in the design and implementation of compilers.

4733 Sequential Machines

(3-0) 3 hours credit. Prerequisite: CS 2743 and MAT 3233 or equivalents.
Discussion of finite-state machines, finite-state automata, Kleene's theorem, pushdown automata and Turing machines.

4743 Formal Theory of Languages and Automata

(3-0) 3 hours credit. Prerequisite: CS 4733.
Relationships between languages and automata, regular grammars, context-free grammars, and their significance in language and compiler design.

4753 Fundamentals of Operating Systems

(3-0) 3 hours credit. Prerequisite: CS 2743 and CS 2734.
Topics discussed to include multiprogramming, multiprocessing, segmentation, paging, deadlocks, semaphores, and scheduling.

4783 Information Storage and Retrieval

(3-0) 3 hours credit. Prerequisite: CS 3783.
Discussion of methods for storage and retrieval of large scale data bases.

4953 Special Studies in Computer Science

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

4911-3 Independent Study

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

COURSE DESCRIPTIONS

SYSTEMS DESIGN (SD)

2815 Digital Circuits Design I

(3-4) 5 hours credit. Prerequisite: CS 1723.
An introduction to modern integrated digital computer circuits. Basics of DTL, TTL, and MOS technologies. Hardware realizations of logical equations. Implementation of digital arithmetic.

2835 Digital Circuits Design II

(3-4) 5 hours credit. Prerequisite: SD 2815.
Design of synchronous sequential circuits. State minimization techniques. Design of small synchronous processor.

3823 Data Acquisition and Distribution

(2-2) 3 hours credit. Prerequisite: CS 1713.
Fundamentals of assembly language for a minicomputer. Programming techniques used to interface and minicomputer to scientific laboratory instrumentation. Analog and digital data formats and characteristics.

3833 Real-Time Digital Control

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

3843 Minicomputer Systems Architecture

(3-0) 3 hours credit. Prerequisite: SD 2835.
A presentation of the hardware organization and systems architecture of state-of-the-art minicomputer systems. Topics include instruction decoding and central pro-

cessor organization, memory organization, floating-point processor organization, input-output functions and direct memory access, writable control store organization and micro-programming.

3853 Instrumentation Circuits Design

(3-0) 3 hours credit. Prerequisites: SD 2815, SD 3823, PHY 1923.

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

3863 Real-Time Operating Systems for Minicomputers

(3-0) 3 hours credit. Prerequisites: SD 3843 and SD 3833.

A study in the design of real-time operating systems for minicomputers. Memory management. Task scheduling in a multitask environment, input/output scheduling, and spooling.

3873 Analog Simulation

(2-2) 3 hours credit. Prerequisite: MAT 1223.

Operational amplifier principles, summers, integrators, multipliers, magnitude and time scaling, the inverse function principle for operational amplifiers. Techniques for simulation of mechanical, electrical, and biological systems.

4613 Operations Research I

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

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

4623 Operations Research II

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

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

4633 Simulation

(3-0) 3 hours credit. Prerequisite or corequisite: SD 4623.

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

4643 Systems Design Laboratory

(0-6) 3 hours credit. Prerequisite or corequisite: SD 4623.

A project oriented course designed to give students experience in applying system analysis and design procedures. Subject matter may include development, evaluation and implementation of models for socio-technical systems, such as health care systems, water resource systems, and urban systems. Activities include written project proposal and technical report. May be repeated for credit. Not more than 6 hours can be counted for a degree.

4803 Microprocessor Laboratory I

(0-6) 3 hours credit. Prerequisite: SD 3843.

Principles of large-scale integration. Organization and systems architecture of state-of-the-art microprocessors. Large scale integration of random access memory and programmable read-only memory. Assemblers, compilers, and operating systems for microprocessors.

4813 Microprocessor Laboratory II

(0-6) 3 hours credit. Prerequisite: SD 4803.

Students execute projects dealing with the design and implementation of microprocessor software for selected applications in the area of process control.

4823 System Analysis

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

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

4833 Optimal Control

(3-0) 3 hours credit. Prerequisite: SD 4823.

Stability and Liapunov's method. Formulation of state equations for continuous and discrete systems. Formulation of the optimal control problem. Pontryagin's maximum principle. Dynamic programming; adaptive control systems.

4853 Computer Interfaces

(3-0) 3 hours credit. Prerequisite: SD 4803.

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

4911-3 Independent Study

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

4953 Special Studies in Systems Design

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

An organized course offering 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 within any one area will apply to a bachelor's degree.