The College of Sciences and Mathematics is organized into three Divisions: 1) Allied Health and Life Sciences, 2) Earth and Physical Sciences, and 3) Mathematics, Computer Science, and Systems Design. These Divisions encompass the subject matter of traditional science departments. Degree programs are offered in Biology; Medical Technology; Occupational Therapy; Physical Therapy; Applied Science; Chemistry, and Mathematics, Computer Science, and Systems Design, which provide education in the theoretical foundations of each discipline while stressing applied aspects. This reflects the creative tension which has always existed between inwardly directed and applied science. It also attempts to speak to the needs of the community in which the University is located. Having a strong technical and career thrust, the College prepares students as mathematics and science teachers, medical laboratory technicians, industrial chemists and physicists, geologists, biostatisticians, and computer scientists. It also offers preprofessional courses of study for students preparing for careers in medicine, dentistry, and nursing.

The College of Sciences and Mathematics also offers a unique new program under which students intending to major in the sciences can complete most of the requirements for their major in the freshman and sophomore years. The general education requirements can be met in the later semesters. For special advantages of this RULE (Restructuring Undergraduate Learning Experience) program, direct your inquiries to the office of the Dean of the College of Sciences and Mathematics.
DIVISION OF ALLIED HEALTH AND LIFE SCIENCES

The Division offers numerous degree options so that a highly individualized program may be developed around the interests of the student. The Biology major proceeds from a comprehensive core curriculum and related offerings in chemistry, physics and mathematics into more highly specialized areas of the life sciences, such as physiology, genetics, microbiology, biochemistry, environmental biology and molecular biology. A major in Biology prepares the student for laboratory positions in industry and government and fulfills requirements for entrance into graduate school, medical school, dental school, and schools of allied health.

ALLIED HEALTH PROGRAMS

A very wide variety of careers exist today in the allied health field ranging from those calling for direct contact with the patient in rehabilitation and therapy programs to the performance of detailed analytical techniques in the clinical laboratory. All hold the satisfaction of contributing to the well-being of others. Because of the diversity of careers in this area, a wide spectrum of skills and talent can be accommodated, necessitating careful planning and counseling to insure that each student selects the program best suited to individual needs.

The University has programs of training in the Allied Health area carried out in cooperation with area health institutions and The University of Texas Health Science Center.

PREPROFESSIONAL COURSES OF STUDY IN THE HEALTH FIELDS

The University of Texas at San Antonio does not offer specific premedical, predental, or prenursing degree programs; rather preprofessional courses of study are available to prepare students for admission to medical, dental, and nursing school.43

43Admission 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.

General Education Courses

The following courses are designed especially to satisfy The University's General Education Requirements:

- BIO 1012, 1021 Life and Living Systems and Laboratory
- BIO 1033, 1041 Human Biology: Anatomy and Physiology and Laboratory
- BIO 1052, 1061 Introductory Microbiology and Laboratory
- BIO 2003 Human Reproduction, Fertility, and Demography
- BIO 2023 Drugs and Society
- BIO 2043 Nutrition
- BIO 2053 Man and His Environment
- BIO 3242, 3251 Field Biology and Ecology and Laboratory
- BIO 4073 Law, Ethics and the Life Sciences
- BIO 4083 Heredity, Evolution, Race and Society

The following sequence is recommended for students who are undecided about a major in Life Sciences:

- BIO 1103, 1111 Principles of Biology and Laboratory
- BIO 1213 Principles of Environmental Biology
- BIO 2313 Genetics

If a major is later declared, all of these courses apply to the major and the student then elects the two laboratories (BIO 1221 and BIO 2321) that accompany Principles of Environmental Biology (BIO 1213) and Genetics (BIO 2313). Other courses in the Life Science curriculum also may be used to satisfy General Education Requirements, provided the student has the required prerequisites.
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."

All candidates for the degree must complete:

A. 40 semester hours in the major, 20 of which must be at the upper-division level.
   1. 20 semester hours in the Biology Core Curriculum are required:
      BIO 1103, 1111 Principles of Biology and Laboratory
      BIO 1213, 1221 Principles of Environmental Biology and Laboratory
      BIO 2313, 2321 Genetics and Laboratory
      BIO 3413, 3421 General Physiology and Laboratory
      BIO 3513, 3521 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.

B. 26 semester hours of support work.
   1. 15 semester hours are required in Chemistry:
      CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop
      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 in Life and Social Sciences I or
      MAT 1213 Calculus I

"Thirty-nine of the total semester hours required for the degree must be at the upper-division level.
3. 8 semester hours are required in Physics:

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

C. 10 semester hours of free electives.

PROGRAMS IN MEDICAL TECHNOLOGY

The medical technologist performs or supervises the performance of laboratory tests which aid physicians in diagnosing diseases and in evaluating the effectiveness of treatment of diseases. These tests are performed in the fields of hematology, chemistry, urinalysis, blood coagulation, immunohematology and blood banking, immunology and serology, and microbiology. Medical technologists work in or direct laboratories in hospitals and clinics, medical schools, governmental health departments, pharmaceutical companies or research institutions. The medical technologist may develop new techniques for the laboratory, contribute toward research, become a laboratory manager, or teach students to become members of the profession.

There are two programs of medical technology at The University of Texas at San Antonio leading to a Bachelor of Science 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 experience in the last half of the fourth year. The integrated program is offered in cooperation with area health institutions.

The academic requirements of these programs are designed not only to give a theoretical basis for laboratory procedures, but also to provide a strong basic science foundation so that medical technologists who later may wish to attend graduate school are qualified academically to do so. The hospital and simulated
student laboratory training provides specialized application of this knowledge and orientation to the clinical laboratories and patient contact environment. The curricula are subject to review by the Council on Medical Education of the American Medical Association through the National Accrediting Agency for the Clinical Laboratory Sciences. Graduates may obtain certification by passing the examination of the Board of Registry of the American Society of Clinical Pathologists.

Because of limited clinical facilities, students wishing to enroll in the Integrated Program should apply for admission to the program upon completion of their first year of university work. Application should be made at the Office of the Division of Allied Health and Life Sciences.
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 141.

Under the program that is offered in three years of academic work followed by one year of clinical training, all candidates for the degree must complete:

A. 63 semester hours in the major:

1. 31 semester hours in the biological sciences:
   - BIO 1103, 1111 Principles of Biology and Laboratory
   - BIO 2313 Genetics
   - BIO 3463, 3471 Human Physiology and Laboratory
   - BIO 3513, 3521 Biochemistry and Laboratory
   - BIO 3713, 3721 Microbiology and Laboratory
   - BIO 4743, 4751 Immunology and Laboratory
   - BIO 4763, 4771 Parasitology and Laboratory
   - BIO 4782, 4792 Pathogenic Microorganisms and Laboratory

2. 32 semester hours (or their equivalents) in the one-year hospital training:
   - BIO 2412, 2422 Hematology and Laboratory
   - BIO 2533, 2542 Parasitology and Urinalysis and Laboratory
   - BIO 3773, 3782 Clinical Chemistry and Laboratory
   - BIO 3862, 3872 Immunohematology and Serology and Laboratory
   - BIO 4843 Advanced Clinical Microbiology
   - BIO 4854 Advanced Clinical Chemistry
   - BIO 4863 Advanced Clinical Hematology
   - BIO 4884 Advanced Immunohematology and Serology

B. 28 semester hours of support work:

1. 15 semester hours are required in Chemistry:
   - CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop
   - CHE 2003 Chemical Principles
   - CHE 2012 Inorganic Qualitative and Quantitative Analysis
   - CHE 2203 Organic Chemistry I
   - CHE 2212 Organic Qualitative Analysis

2. 5 semester hours (in addition to the four semester hours required under the General Education Requirements) are required in Mathematics:
MAT 1062 Statistics
MAT 1213 Calculus I

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

Under the integrated program, all candidates for the degree must complete:

A. 63 semester hours in the major.

1. 31 semester hours are required in the biological sciences:

BIO 1103, 1111 Principles of Biology and Laboratory
BIO 2313 Genetics
BIO 3463, 3471 Human Physiology and Laboratory
BIO 3513, 3521 Biochemistry and Laboratory
BIO 3713, 3721 Microbiology and Laboratory
BIO 4743, 4751 Immunology and Laboratory
BIO 4763, 4771 Parasitology and Laboratory
BIO 4782, 4792 Pathogenic Microorganisms and Laboratory

2. 18 semester hours are required in Medical Technology courses:

BIO 1871 Allied Health Sciences
BIO 1883 Medical Technology
BIO 2412, 2422 Hematology and Laboratory
BIO 2533, 2542 Parasitology and Urinalysis and Laboratory
BIO 3773, 3782 Clinical Chemistry and Laboratory

3. 14 semester hours are required in hospital training courses:

BIO 4843 Advanced Clinical Microbiology
BIO 4854 Advanced Clinical Chemistry
BIO 4863 Advanced Clinical Hematology
BIO 4884 Advanced Immunohematology and Serology

B. 28 semester hours of support work.

1. 15 semester hours are required in Chemistry:

CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop
CHE 2003 Chemical Principles
CHE 2012 Inorganic Qualitative and Quantitative Analysis
CHE 2203  Organic Chemistry I
CHE 2212  Organic Qualitative Analysis

2. 5 semester hours (in addition to the 4 semester hours required under the General Education Requirements) are required in Mathematics:

MAT 1062  Statistics
MAT 1213  Calculus I

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

PROGRAM IN OCCUPATIONAL THERAPY

Occupational therapy is the art and science of directing man's participation in selected tasks to restore, reinforce and enhance performance, facilitate learning of those skills and functions essential for adaptation and productivity, diminish or correct pathology and to promote and maintain health. Its fundamental concern is the development and maintenance of the capacity, throughout the life span, to perform with satisfaction to self and others those tasks and roles essential to productive living and to the mastery of self and the environment. Many different activities and life-tasks, such as daily living skills, creative arts and manual arts, are used to help patients of all ages overcome physical, emotional and other developmental problems. The therapist may work in hospitals and clinics, rehabilitation centers, extended care facilities, workshops, camps, schools, private homes and community agencies.

The degree program is designed to provide each student with educational opportunity for development as a professionally competent entry-level occupational therapist. A strong background is provided in the life sciences, behavioral sciences, humanities and specific skill areas. Specific application of occupational therapy skills in laboratory and clinical settings occurs in the last two years of a student's program and includes a minimum of six months approved field work experience.
Students should apply for admission to the program prior to completion of their second year of university work. Application should be made at the Office of the Division of Allied Health and Life Sciences.

The curriculum is subject to review by the Council on Medical Education of the American Medical Association in collaboration with the American Occupational Therapy Association. The student is awarded a B.S. degree in Occupational Therapy upon completion of the program and is eligible to take the national examination for registration with the American Occupational Therapy Association.
BACHELOR OF SCIENCE DEGREE
IN OCCUPATIONAL THERAPY*

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 144."4

All candidates for the degree must complete:

A. 72 semester hours in the major, 58 of which must be at the upper-division level.

1. 22 semester hours are required in the biological sciences:
   BIO 1103, 1111 Principles of Biology and Laboratory
   BIO 2313, 2321 Genetics and Laboratory or
   BIO 1213, 1221 Principles of Environmental Biology and Laboratory
   BIO 3163, 3173 Human Anatomy and Laboratory
   BIO 3463, 3471 Human Physiology and Laboratory
   BIO 4463, 4471 Human Neurosciences and Laboratory

2. 50 semester hours are required in Occupational Therapy courses:
   BIO 1871 Allied Health Sciences
   BIO 1863 Survey of Physical Medicine and Rehabilitation
   BIO 2862 Occupational Therapy Process
   BIO 3752, 3761 Dynamics of Motion I and Laboratory
   BIO 3793 Occupational Therapy Theory
   BIO 3851 Directed Observation in Occupational Therapy
       (repeated for credit to total 2 hours)
   BIO 3902, 3911 Occupational Therapy: Therapeutic Skills and Laboratory
   BIO 4202, 4211 Dynamics of Motion II and Laboratory
   BIO 4802, 4811 Occupational Therapy Theory and Treatment Planning and Laboratory

*The clinical part of the program is scheduled to begin September, 1977.

"Six semester hours in Sociology in Group C electives and six semester hours in Fine and Applied Arts from Group A electives are selected as part of the General Education Requirements, with the approval of the student's Advisor.
BIO 4823 Occupational Therapy: Management and Consultation
BIO 4836 Clinical Medicine
BIO 4923 Special Project
BIO 4943 Field Work Experience (repeated for credit to total 15 hours)

B. 22 semester hours of support work.

1. 9 semester hours are required in Chemistry:
   CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop
   CHE 2103, 2111 Elementary Organic and Biochemistry and Laboratory

2. 9 semester hours are required in Psychology:
   PSY 2013 Fundamentals of Psychology
   PSY 2503 Developmental Psychology
   PSY 2513 Abnormal Psychology

3. 4 semester hours are required in Art:
   ART 1192 The Manual Arts in Occupational Therapy I
   ART 1202 The Manual Arts in Occupational Therapy II

PROGRAM IN PHYSICAL THERAPY

The physical therapist is a member of the health team who is concerned with restoration of function and the prevention of disability following disease, injury, or loss of a bodily part. The emphasis is to train or retrain the patient to perform activities associated with daily living and to overcome emotional barriers to recovery. Physical therapists work in hospitals, rehabilitation facilities, private offices, long-term care facilities, nursing homes and schools. The degree program emphasizes the biological and physical sciences essential for understanding the functioning of the human body, as well as the humanities, social sciences, behavioral sciences and skill areas. Preclinical and clinical experience is taken in the last two years of a student's program.

Students should apply for admission to the program prior to
completion of their second year of university work. Application should be made at the Office of the Division of Allied Health and Life Sciences.

The curriculum is subject to review by the Council on Medical Education of the American Medical Association in collaboration with the American Physical Therapy Association. The student is awarded a B.S. degree in Physical Therapy upon completion of the program and is eligible to take the state licensure examination.
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 136.

All candidates for the degree must complete:

A. 61 semester hours in the major, 42 of which must be at the upper-division level.

1. 22 semester hours are required in the biological sciences:
   BIO 1103, 1111 Principles of Biology and Laboratory
   BIO 2313, 2321 Genetics and Laboratory
   BIO 2123, 2131 Comparative Anatomy and Vertebrates and Laboratory
   BIO 3163, 3173 Human Anatomy and Laboratory
   BIO 4463, 4471 Human Neurosciences and Laboratory

2. 39 semester hours are required in Physical Therapy courses:
   BIO 1871 Allied Health Sciences
   BIO 1863 Survey of Physical Medicine and Rehabilitation
   BIO 2751 Physical Therapy: History and Philosophy
   BIO 2762 Physical Therapy Procedures
   BIO 3752, 3761 Dynamics of Motion I and Laboratory
   BIO 3883, 3893 Therapeutic Concepts and Procedures in Physical Therapy and Laboratory
   BIO 4202, 4211 Dynamics of Motion II and Laboratory
   BIO 4222, 4231 Advanced Concepts and Procedures in Physical Therapy and Laboratory
   BIO 4836 Clinical Medicine

"The clinical part of the program is scheduled to begin September, 1977.

"The student is required to complete 6 hours in Group A electives and 9 hours in Psychology and Sociology as Group C electives for General Education Requirements.

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BIO 4871 Preclinical Training (repeated for credit to total 2 hours)
BIO 4923 Special Project
BIO 4933 Clinical Education (repeated for credit to total 6 hours)

B. 25 semester hours of support work.

1. 14 semester hours are required in Chemistry:
   CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop
   CHE 2003 Chemical Principles
   CHE 2012 Inorganic Qualitative and Quantitative Analysis
   CHE 2103, 2111 Elementary Organic and Biochemistry and Laboratory

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

3. 3 semester hours in Sociology and Psychology selected with the approval of the student’s Advisor.

COURSE DESCRIPTIONS

BIOLOGY

1012 LIFE AND LIVING SYSTEMS
   (2-0) 2 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.

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 1012. Laboratory exercises, films and demonstrations in biology.

1033 HUMAN BIOLOGY: ANATOMY AND PHYSIOLOGY
   (3-0) 3 hours credit. Prerequisite: BIO 1012, or 1103 or consent of instructor. May not be applied to a major in this Division. The structure of human muscular, skeletal, nervous and organ systems as related to function.
1041 ANATOMY AND PHYSIOLOGY LABORATORY
(0-3) 1 hour credit. May not be applied to a major in this Division. Must be taken concurrently with BIO 1033.

1052 INTRODUCTORY MICROBIOLOGY
(2-0) 2 hours credit. Prerequisite: BIO 1012, 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 BIO 1052.

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.

1111 PRINCIPLES OF BIOLOGY LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 1103.

1213 PRINCIPLES OF ENVIRONMENTAL BIOLOGY
(3-0) 3 hours credit. Prerequisites: BIO 1103, and BIO 1111.
The interaction of organisms with their environment, ecological principles, adaptations of organisms, ecology, environmental pollution and principles of conservation.

1221 PRINCIPLES OF ENVIRONMENTAL BIOLOGY LABORATORY
(0-3) 1 hour credit.
Biology majors must take this concurrently with BIO 1213; optional for non-majors.

1863 SURVEY OF PHYSICAL MEDICINE AND REHABILITATION
(3-0) 3 hours credit. Prerequisite: BIO 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.

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: BIO 1871.
Clinical laboratory safety, specimen collection and preservation, quality controls, medical laboratory calculations, reagent preparation and medical technical terminology.

2003 HUMAN REPRODUCTION, FERTILITY, AND DEMOGRAPHY
(3-0) 3 hours credit. Prerequisites: BIO 1012 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.

2023 DRUGS AND SOCIETY  
(3-0) 3 hours credit. Prerequisites: BIO 1012 or 1103 or consent of instructor. May not be applied to a major in this Division. An examination of drugs and their role in society.

2043 NUTRITION  
(3-0) 3 hours credit. Prerequisites: BIO 1033, 1041, or BIO 1103, 1111. An examination of human nutritional needs from infancy to adulthood.

2053 MAN AND HIS ENVIRONMENT  
(3-0) 3 hours credit. Prerequisite: BIO 1012, or 1103 or consent of instructor. May not be applied to a major in this Division. The interaction of man with the eco-system and its consequences.

2063 INVERTEBRATE BIOLOGY  
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1111. 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, 1111. 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, 1111. 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, 1111, 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.

2321 GENETICS LABORATORY  
(0-3) 1 hour credit.
Must be taken concurrently or following BIO 2313. Optional for non-majors.

2343 INTRODUCTION TO PLANT SCIENCES
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1111. The life histories and phylogenetic relationships of vascular and non-vascular plants. Emphasis on form, structure, function and development of higher plants.

2351 INTRODUCTION TO PLANT SCIENCES LABORATORY
(0-3) 1 hour credit. Must be taken concurrently with BIO 2343.

2412 HEMATOLOGY
(2-0) 2 hours credit. Prerequisite: BIO 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 BIO 2412. Clinical hematological laboratory.

2533 PARASITOLOGY AND URINALYSIS
(3-0) 3 hours credit. Prerequisite: BIO 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 BIO 2533. Clinical human parasitology and urinalysis.

2751 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.

2762 PHYSICAL THERAPY PROCEDURES
(2-0) 2 hours credit. Prerequisite: Consent of the instructor. Fundamental concepts for basic patient care and management.

2862 OCCUPATIONAL THERAPY PROCESS
(2-0) 2 hours credit. Prerequisite: Consent of the instructor. Principles and theories of occupational therapy; professional role and function, history, organization and concepts.

3012 INTRODUCTORY PATHOLOGY
(2-0) 2 hours credit. Prerequisites: BIO 1103, 1111 or BIO 1033, 1041. Concepts of disease and diagnosis of pathological conditions.

3021 INTRODUCTORY PATHOLOGY LABORATORY
(0-2) 1 hour credit. Must be taken concurrently with BIO 3012. Optional for non-majors.
3113 KINESIOLOGY  
(3-0) 3 hours credit. Prerequisite: BIO 1033 or BIO 2123.  
A study of the principles of human motion.

3143 COMPARATIVE VERTEBRATE EMBRYOLOGY  
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3421.  
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.

3163 HUMAN ANATOMY  
(3-0) 3 hours credit. Prerequisite: BIO 2123 and consent of instructor.  
Lectures and demonstrations on the structure of the human body.

3173 HUMAN ANATOMY LABORATORY  
(0-9) 3 hours credit.  
Must be taken concurrently with BIO 3163. Includes prossections, demonstrations and dissections of human material.

3213 ANIMAL ECOLOGY  
(3-0) 3 hours credit. Prerequisites: BIO 1213, 1221.  
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 1203 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, 1111 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.
3413 GENERAL PHYSIOLOGY  
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1111, CHE 2203, 2212.  
Fundamental properties and processes in living systems.

3421 GENERAL PHYSIOLOGY LABORATORY  
(0-3) 1 hour credit.  
Must be taken concurrently with BIO 3413.

3463 HUMAN PHYSIOLOGY  
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1111, CHE 2103 or 2203.  
Physiological processes in human systems.

3471 HUMAN PHYSIOLOGY LABORATORY  
(0-3) 1 hour credit.  
Must be taken concurrently with BIO 3463.

3513 BIOCHEMISTRY  
(3-0) 3 hours credit. Prerequisites: CHE 2203, 2212.  
Introduction to biochemistry: amino acids; protein structures; enzyme action; lipids and saccharides; metabolism; nucleic acids and molecular biology.

3521 BIOCHEMISTRY LABORATORY  
(0-3) 1 hour 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, 3521.  
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 2343, 2351.  
A comprehensive treatment of the development, function and evolutionary significance of the internal structure of plants.

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, 3521 or concurrent registration.  
A comprehensive study of microorganisms including their composition, morphology, growth, metabolism, classification, ecology and significance in disease.
3721 MICROBIOLOGY LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 3713.

3732 INDUSTRIAL MICROBIOLOGY
(2-0) 2 hours credit. Prerequisites: BIO 3713, 3721.
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.

3752 DYNAMICS OF MOTION I
(2-0) 2 hours credit. Prerequisites: BIO 3463 or BIO 3163 and approval of the appropriate Allied Health Admissions Committee.
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 BIO 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 BIO 3773.
Analytical clinical chemistry techniques and automated clinical instrumentation with quality controls and blood analyses.

3793 OCCUPATIONAL THERAPY THEORY
(3-0) 3 hours credit. Prerequisite: BIO 2862 and approval of Occupational Therapy Admissions Committee.
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.

3813 CELLULAR BIOLOGY
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1111, CHE 2203.
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, 3521.
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.

3851 DIRECTED OBSERVATION IN OCCUPATIONAL THERAPY
(0-5) 1 hour credit. Prerequisite: Approval of the Allied Health Admissions Committee in Occupational Therapy.
Directed observation and participation in selected field settings. To be repeated for credit to a total of two hours.

3862 IMMUNOHEMATOLOGY AND SEROLOGY
(2-0) 2 hours credit. Prerequisites: BIO 2412, 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 BIO 3862.
Blood banking techniques and serological assays including radio immune assay procedures.

3883 THERAPEUTIC CONCEPTS AND PROCEDURES IN PHYSICAL THERAPY
(3-0) 3 hours credit. Prerequisite: Approval of Physical Therapy Admissions Committee.
Theory and application of the use of physical agents in patient treatment.

3893 THERAPEUTIC CONCEPTS LABORATORY
(0-9) 3 hours credit.
Must be taken concurrently with BIO 3883.

3902 OCCUPATIONAL THERAPY: THERAPEUTIC SKILLS
(2-0) 2 hours credit. Prerequisite: BIO 3793 and approval of Occupational Therapy Admissions Committee.
Identification, analysis and adaptation of life tasks and activities related to age-specific needs, capacities and roles.

3911 THERAPEUTIC SKILLS LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 3902.

4073 LAW, ETHICS AND THE LIFE SCIENCES
(3-0) 3 hours credit. Prerequisite: BIO 1103, 1111 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.

4083 HEREDITY, EVOLUTION, RACE AND SOCIETY
(3-0) 3 hours credit. Prerequisite: BIO 1103, 1111 or consent of instructor. May not be applied to a major in this Division.
A study of variation and evolutionary change in relation to
human thought, experience, cultural evolution, diversity and mating systems.

4202 DYNAMICS OF MOTION II
(2-0) 2 hours credit. Prerequisite: BIO 3752.
Analysis and evaluation of movement disorders and the use of assistive devices for their prevention and correction. A continuation of BIO 3752.

4211 DYNAMICS OF MOTION II LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 4202.

4222 ADVANCED CONCEPTS AND PROCEDURES IN PHYSICAL THERAPY
(2-0) 2 hours credit. Prerequisite: Approval of Physical Therapy Admissions Committee.
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 BIO 4222.

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, 2321.
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, 2321, 3513, 3521.
Molecular approach to structure, replication, mutation and phenotypic expression of genetic material.

4353 COMPARATIVE PHYSIOLOGY
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3421.
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.
4413 MAMMALIAN PHYSIOLOGY
(3-0) 3 hours credit. Prerequisite: BIO 3413, 3421 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 BIO 4413.

4433 NEUROBIOLOGY
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3421.
Anatomy and physiology of nervous systems, the mechanisms of neuronal functions.

4443 ENDOCRINOLOGY
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3421, 3513, 3521.
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.

4463 HUMAN NEUROSCIENCES
(3-0) 3 hours credit. Prerequisite: BIO 3413 or 3463.
Structure and function of the human nervous system.

4471 HUMAN NEUROSCIENCES LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 4463.

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, 3521.
A detailed consideration of metabolic pathways, energy metabolism and their regulation.

4531 INTERMEDIARY METABOLISM LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 4523.

4543 BIOCHEMICAL TECHNIQUES
(0-6) 3 hours credit. Prerequisites: BIO 3513, 3521.
Laboratory experience in methods of biochemical fractionation, purification and analysis of components.

4603 PLANT PHYSIOLOGY
(3-0) 3 hours credit. Prerequisites: BIO 2343, 2351, CHE 2203,
Principles of organization of cellular activity and molecular structure of protoplasm; with emphasis on 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, 3721, 3513, 3521.  
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, 3721, 3513, 3521.  
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, 3721.  
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.

**4782 PATHOGENIC MICROORGANISMS**  
(2-0) 2 hours credit. Prerequisites: BIO 3713, 3721.  
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 BIO 4782.

**4802 OCCUPATIONAL THERAPY THEORY AND TREATMENT PLANNING**  
(2-0) 2 hours credit. Prerequisite: Approval of Occupational Therapy Admissions Committee. Overview of life tasks and adaptive skills of the developing human; treatment planning and professional communications with field observations.
4811 OCCUPATIONAL THERAPY THEORY AND PLANNING LABORATORY
(0-3) 1 hour credit.
Must be taken concurrently with BIO 4802.

4823 OCCUPATIONAL THERAPY: MANAGEMENT AND CONSULTATION
(3-0) 3 hours credit. Prerequisite: Approval of Occupational Therapy Admissions Committee.
Planning, organizing, supervising, and implementing occupational therapy services as a line function and as a consultant; legal and ethical considerations.

4836 CLINICAL MEDICINE
(6-0) 6 hours credit. Prerequisites: BIO 3463 and approval of the appropriate Allied Health Admissions Committee.
Lectures covering the various areas of medicine and surgery emphasizing the conditions commonly encountered in physical medicine and rehabilitation.

4843 ADVANCED CLINICAL MICROBIOLOGY
(2-6) 3 hours credit. Prerequisite: Approval of Medical Technology Admissions Committee. An integrated lecture and laboratory with emphasis on abnormal microbial flora found in diseased humans.

4854 ADVANCED CLINICAL CHEMISTRY
(2-9) 3 hours credit. Prerequisite: Approval of Medical Technology Admissions Committee. 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 Admissions Committee. An integrated lecture and laboratory with emphasis on blood pictures, bone marrows and hematological findings of diseased states.

4871 PRECLINICAL TRAINING
(0-5) 1 hour credit. Prerequisite: Approval of the Allied Health Admissions Committee in Physical Therapy.
Observations and practical experience in a clinical setting. May be repeated for credit to a total of two hours by permission.

4884 ADVANCED IMMUNOHEMATOLOGY AND SEROLOGY
(2-9) 4 hours credit. Prerequisite: Approval of Medical Technology Admissions Committee.
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 Division Director. An intensive supervised student project.

4933 CLINICAL EDUCATION
(0-15) 3 hours credit. Prerequisite: Approval of the Allied Health Admissions Committee in Physical Therapy. Supervised training in a treatment setting to fulfill professional curriculum requirements. May be repeated for credit to a total of six hours.

4943 FIELD WORK EXPERIENCE
(0-15) 3 hours credit. Prerequisite: Approval of the Allied Health Admissions Committee in Occupational Therapy. In-depth experience in and responsibility for the delivery of health care services to patient/clients. May be repeated for credit to a total of fifteen hours.

4953 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.
DIVISION OF EARTH AND
PHYSICAL SCIENCES

The degree programs offered by this Division reflect its policy of providing comprehensive education of the highest quality, individualized to the needs and interests of the student. Completion of a core curriculum permits entry into one of several highly specialized areas in Applied Science (Applied Geology, Applied Physics, Food Technology, Polymer Science) or Chemistry. A major in any of these prepares the student for positions in industry and government as well as entry into professional and graduate schools. The recommended programs for majors concentrate much of the specialty in the early years, thereby permitting increased specialization later in the university career.

A major in any of the Applied Science concentrations provides a sound background for completion of an engineering degree program with a minimum of duplication in course material. The Bachelor of Science in Applied Science has three major goals: (1) to prepare a student for employment in one of the concentrations (Applied Geology, Applied Physics, Food Technology and Polymer Science), (2) to provide the fundamental courses enabling a student to transfer to The University of Texas at Austin to complete a degree program in Civil Engineering, Environmental Engineering, Chemical Engineering, Electrical Engineering or Engineering Science, and (3) to provide the background necessary for graduate study in a variety of science and engineering specialty areas.

A. Applied Geology

The severe shortages occurring in the materials needed to maintain an industrial civilization call for a growth in manpower and technology in the area of Applied Geology. Graduates of this program work in mineral exploration and development, water resources, environmental geology...

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*The Food Technology concentration is not offered in 1976-78. Students interested in this concentration should consult the Director of the Division of Earth and Physical Sciences.

*Same as footnote number 49 above.
and other applications. In addition, the program provides a strong background for continued study at the graduate level.

B. Applied Physics

The Applied Physics concentration is intended for students who wish to pursue an industrial career involving the numerous practical applications of physics. Modern discoveries such as radar, transistors, and computers are exemplary of such training. The program emphasizes a unique combination of fundamental concepts of physics with the vast potential for their industrial applications. Graduates trained under this program find employment opportunities in areas such as newer forms of energy, newer forms of communication and transportation and newer industrial aspects of sound and light. Industries dealing with satellite communications, solar energy utilization, and efficient conversion of chemical energy into mechanical energy are among those job opportunities for graduates of this concentration. The basic physics component of this concentration remains sufficiently strong to meet the needs of students who plan graduate work in physics, as well as those planning graduate work in other sciences and medicine.

C. Food Technology

The Food Technology concentration is formulated on the basis of the broad-based food industry in the nation and in the State of Texas. Graduates in this area find opportunities in the food industries. Examples are the production of cotton seed oil, peanut butter, cotton seed protein, dairy products, fruits, meat and meat by-products.

Major upper-division courses required for this concentration will appear in the next issue of the Undergraduate Catalog. Students interested in this concentration should consult the Director of the Division of Earth and Physical Sciences.

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*Same as footnote number 49*
D. Polymer Science

The Polymer Science concentration is formulated on the basis of relevance to local and national needs, estimated present and future job market trends, and local resources in the petrochemical industries. Many industrial polymers are derived from petroleum. Examples are paints and coatings, synthetic fibers, polymer foams, photographic films and printing inks. Transportation, construction, furniture and bedding, flotation, packaging, footwear and numerous other consumer needs are strongly dependent upon a polymer-science base.

For those students who seek a formal 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. For example, the program enables UT San Antonio graduates in Applied Science to earn 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 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.
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 128.\textsuperscript{52}

All candidates for the degree must complete the following core of 33 semester hours in the sciences and mathematics:

\begin{itemize}
  \item AS 2902 Introduction to Applied Science \textit{or}
  \item AS 2912 Introduction to Engineering
  \item AS 4923 Special Studies Project
  \item AS 4933 Practicum in Applied Science
  \item CHE 1103 Introductory Chemistry
  \item CHE 2012 Inorganic Qualitative and Quantitative Analysis
  \item CHE 2003 Chemical Principles
  \item MAT 1213 Calculus I
  \item MAT 1223 Calculus II
  \item CS 1713 Introduction to Computer Science
  \item PHY 1903 Technical Physics I
  \item PHY 1911 Technical Physics I Laboratory
  \item PHY 1923 Technical Physics II
  \item PHY 1931 Technical Physics II Laboratory
\end{itemize}

In addition, students must complete 45 semester hours selected with approval of the students' Advisor from one of the following Applied Science concentrations:

\textbf{Applied Geology}

A. 35 semester hours in the \textit{major}, 21 of which must be at the upper-division level.

1. 23 semester hours of required courses are:

\begin{itemize}
  \item AS 1002 Interpreting the Earth
  \item AS 1011 Interpreting the Earth Laboratory
  \item AS 1022 Earth History and Stratigraphy
  \item AS 1031 Earth History and Stratigraphy Laboratory
  \item AS 2002 Earth Materials I
\end{itemize}

\textsuperscript{52}Thirty-nine of the total credit hours required for the degree must be at the upper-division level.
AS 2012 Earth Materials I Laboratory
AS 3022 Earth Materials II
AS 3032 Earth Materials II Laboratory
AS 3102 Structural Geology: Map and Photo Analysis
AS 3111 Structural Geology: Map and Photo Analysis Laboratory
AS 3122 Surface Processes and Sedimentary Geology
AS 3131 Surface Processes and Sedimentary Geology Laboratory
AS 4943 Field Methods in Geology

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

AS 3142 Economic Geology I: Metals and Industrial Minerals
AS 3163 Oceanography
AS 3182 Economic Geology II: Fuels
AS 3191 Economic Geology II: Fuels — Laboratory
AS 4022 Engineering Geology
AS 4042 Hydrogeology
AS 4053 Hydrology
AS 4062 Principles of Environmental Geology

B. 10 semester hours of approved support work at the upper-division level.

Applied Physics

A. 39 semester hours in the major, all of which must be at the upper-division level.

1. 16 semester hours of required courses are:

AS 3223 Electronics
AS 3231 Electronics Laboratory
AS 3263 Microphysics
AS 3283 Electricity and Magnetism
AS 3293 Thermodynamics and Statistical Mechanics
AS 3383 Dynamics

2. 23 additional semester hours of approved elective courses in Applied Science at the upper-division

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With the consent of the student's Advisor, up to 12 hours may be in upper-division Mathematics, Computer Science, Systems Design, or Chemistry courses.
level are required from the following:

- AS 3203 Circuit Analysis
- AS 3211 Circuit Analysis Laboratory
- AS 3273 Statics
- AS 3303 Alternative Energy Sources
- AS 3312 Experimental Physics I
- AS 3323 Wave Motion
- AS 3332 Experimental Physics II
- AS 3363 Biophysics I
- AS 3373 Biophysics II
- AS 4263 Introduction to Quantum Mechanics
- AS 4283 Electromagnetic Radiation
- AS 4293 Fluid Mechanics
- AS 4323 Acoustics
- AS 4331 Acoustics Laboratory
- AS 4363 Nuclear Energy: Fission and Fusion
- AS 4373 General Geophysics
- AS 4382 Exploration Geophysics
- AS 4391 Exploration Geophysics Laboratory

B. 6 semester hours of required support work in Mathematics:

- MAT 2213 Calculus III
- MAT 3243 Calculus for Applications

Polymer Science

A. 19 semester hours in the major, all of which must be at the upper-division level.

1. 12 semester hours of required courses are:

- AS 3603 Polymer Science I
- AS 3611 Polymer Science I Laboratory
- AS 3623 Polymer Science II
- AS 3631 Polymer Science II Laboratory
- AS 4653 Polymer Technology
- AS 4661 Polymer Technology Laboratory

2. 7 additional semester hours of approved elective courses in Applied Science at the upper-division level to be chosen from the following:

- AS 3643 Natural and Synthetic Organic Polymers
- AS 3651 Natural and Synthetic Organic Polymers Laboratory
AS 4623 Coatings Technology
AS 4703 Organic Chemistry of Coatings
AS 4723 Corrosion
AS 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 coursework are required in physical chemistry, organic chemistry, biochemistry, biology, physics, and/or 4000-level polymer science courses.

COURSE DESCRIPTIONS

APPLIED SCIENCE (AS)

1002 INTERPRETING THE EARTH
(2-0) 2 hours credit. Concurrent registration for AS 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
(0-3) 1 hour credit. Concurrent registration for AS 1002 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: AS 1002 and 1011. Concurrent registration for AS 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: AS 1002 and 1011. Concurrent registration for AS 1022 required; exceptions with consent of instructor. Laboratory study of fossils and rock sequences; interpretation of Earth history.

1902 ENGINEERING DRAWING
(1-3) 2 hours credit.
Freehand and instrument drawing; shape and size description; pictorial methods; freehand lettering; charts and graphs.

2002 EARTH MATERIALS I
(2-0) 2 hours credit. Concurrent registration for AS 2012 required; exceptions with consent of instructor. Crystallography, chemistry, physical properties and origin of minerals. Principles and methods of optical crystallography.

2012 EARTH MATERIALS I LABORATORY
(0-6) 2 hours credit. Concurrent registration for AS 2002 required; exceptions with consent of instructor. Laboratory study of crystal models, minerals, and use of the petrographic microscope for the identification of minerals in immersion liquids and in thin section.

2902 INTRODUCTION TO APPLIED SCIENCE
(2-0) 2 hours credit.
Discussions which compare and contrast the nature of, and the difference between, the basic and applied sciences. Some fundamental skills, necessary in all quantitative sciences, are also considered (e.g., basic theory of errors, units, etc.)

2912 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.

2951 SPECIAL INTEREST TOPICS
(1-0) 1 hour 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.

3022 EARTH MATERIALS II
(2-0) 2 hours credit. Prerequisites: AS 2002 and 2012. Concurrent registration for AS 3032 required; exceptions with consent of instructor. Description, occurrence, and origin of igneous, metamorphic, and sedimentary rocks.
3032 EARTH MATERIALS II LABORATORY
(0-6) 2 hours credit. Prerequisites: AS 2002 and 2012. Concurrent registration for AS 3022 required; exceptions with consent of instructor.
Laboratory study of rocks in hand specimen and thin section.

3102 STRUCTURAL GEOLOGY: MAP AND PHOTO ANALYSIS
(2-0) 2 hours credit. Prerequisites: AS 1002 and 1011. Concurrent registration for AS 3011 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
(0-3) 1 hour credit. Prerequisites: AS 1002 and 1011. Concurrent registration for AS 3002 required; exceptions with consent of instructor.
Laboratory study of structural interpretation using maps, cross-sections, air photos, and descriptive geometric and stereographic methods.

3122 SURFACE PROCESSES AND SEDIMENTARY GEOLOGY
(2-0) 2 hours credit. Prerequisites: AS 2022 and 2032. Concurrent registration for AS 3031 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: AS 2022 and 2032. Concurrent registration for AS 3022 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: AS 1002 and 1011.
Ore and industrial mineral genesis. Description and distribution of the major mineral deposits.

3163 OCEANOGRAPHY
(3-0) 3 hours credit. Prerequisite: AS 3122.
General oceanography, with emphasis on marine geology and especially the continental margins.

3182 ECONOMIC GEOLOGY II: FUELS
(2-0) 2 hours credit. Prerequisites: AS 1002, 1011, 1022, and 1031.
Concurrent registration for AS 3091 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: AS 1002, 1011, 1022, and 1031. Concurrent registration for AS 3082 required; exceptions with consent of instructor.
Laboratory studies of samples, maps and logs. Preparation of sample logs and subsurface maps.

3203 CIRCUIT ANALYSIS
(3-0) 3 hours credit. Prerequisites: PHY 1923, CS 1713 and MAT 2213. AS 3211 should be taken concurrently.
Steady state analysis of linear DC and AC networks. The course emphasizes matrix analysis and computer methods.

3211 CIRCUIT ANALYSIS LABORATORY
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS 3203.
Laboratory to accompany AS 3203.

3223 ELECTRONICS
(3-0) 3 hours credit. Prerequisite: PHY 1923. AS 3231 should be taken concurrently.
Introduction to DC and AC circuits, electronic components and their uses in basic circuits for instrumentation commonly encountered in the scientific laboratory.

3231 ELECTRONICS LABORATORY
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS 3223.
Laboratory to accompany AS 3223.

3243 ELECTRONIC CIRCUITS
(3-0) 3 hours credit. Prerequisite: AS 3223. AS 3251 should be taken concurrently.
Design of linear amplifiers, power supplies and other basic electronic instrumentation in common use.

3251 ELECTRONIC CIRCUITS LABORATORY
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS 3243.
Laboratory to accompany AS 3243.

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.

3273 STATICS
(3-0) 3 hours credit. Prerequisite: PHY 1903 and MAT 1223.
Vector algebra, force systems, free body diagrams. Engineering applications of equilibrium, centroids, moments of inertia.

3283 ELECTRICITY AND MAGNETISM
(3-0) 3 hours credit. Prerequisite: PHY 1923. Prerequisite or concurrent enrollment: MAT 3243.
Theory and applications of electrostatics, currents, magnetic fields. Introduction to Maxwell's equations.

3293 THERMODYNAMICS AND STATISTICAL MECHANICS
(3-0) 3 hours credit. Prerequisites: PHY 1923, CHE 2003, and MAT 2213.

3303 ALTERNATIVE ENERGY SOURCES
(3-0) 3 hours credit. Prerequisites: PHY 1923 and CHE 2003. AS 3312 should be taken concurrently.

3312 EXPERIMENTAL PHYSICS I
(0-6) 2 hours credit. Prerequisite or concurrent enrollment: AS 3303.
Laboratory to accompany AS 3303. Experiments applicable to energy studies. May include field trips.

3323 WAVE MOTION
(3-0) 3 hours credit. Prerequisites: MAT 2213 and an upper division Physics lecture course. AS 3332 should be taken concurrently.
The essential features of wave motion and its applications primarily in physical optics. Optical correlation techniques, lasers, holography, fiber optics, magneto- and electro-optical phenomena and their applications are covered as time permits.

3332 EXPERIMENTAL PHYSICS II
(0-6) 2 hours credit. Prerequisite or concurrent enrollment: AS 3323.
Laboratory to accompany AS 3323. Experiments mainly in optics.

3363 BIOPHYSICS I
(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, macro-molecules, interaction of radiation with biological materials.

3373 BIOPHYSICS II
(3-0) 3 hours credit. Prerequisite: AS 3363.
Study of biological systems from a physicist's point of view. Topics are: molecular transformations and methods of regulation, survey of physical experimental techniques in molecular biophysics, macroscopic structures in the context of molecular biophysics, and thermodynamics of living systems.

3383 DYNAMICS
(3-0) 3 hours credit. Prerequisite: PHY 1923. Prerequisite or concurrent enrollment: MAT 2213.
Kinematics and dynamics of a particle, systems of particles, rigid body motion in a plane. Applications are emphasized.
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.

3611 POLYMER SCIENCE I LABORATORY  
(0-3) 1 hour credit. Prerequisite: AS 3603 or concurrent registration.
Laboratory projects illustrating and extending the concepts discussed in AS 3603.

3623 POLYMER SCIENCE II  
(3-0) 3 hours credit. Prerequisite: AS 3603.
Structural and physical aspects of polymers; molecular basis for polymer properties and behavior; the rubbery, glassy and crystalline states; viscoelasticity and rubber elasticity; glass transition; structure, morphology, mechanical, optical and electrical properties.

3631 POLYMER SCIENCE II LABORATORY  
(0-3) 1 hour credit. Prerequisite: AS 3623 or concurrent registration.
Laboratory projects illustrating and extending the concepts discussed in AS 3623.

3643 NATURAL AND SYNTHETIC ORGANIC POLYMERS  
(3-0) 3 hours credit. Prerequisite: AS 3623.
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: AS 3643 or concurrent registration.
Laboratory projects illustrating and extending the concepts discussed in AS 3643.

4022 ENGINEERING GEOLOGY  
(2-0) 2 hours credit. Prerequisite: AS 1002 and 1011 and consent of instructor.
Geologic factors in the construction of large structures and excavations. Physical properties of natural materials. Case studies.

4042 HYDROGEOLOGY  
(2-0) 2 hours credit. Prerequisites: AS 1002 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 ground water supplies.
4053 HYDROLOGY  
(3-0) 3 hours credit. Prerequisite: AS 4293 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.

4062 PRINCIPLES OF ENVIRONMENTAL GEOLOGY  
(2-0) 2 hours credit. Prerequisites: AS 1002 and 1011 and consent  
of instructor.  
Geologic factors important to city and regional planning.  
Land capability studies; geologic hazards.

4263 INTRODUCTION TO QUANTUM MECHANICS  
(3-0) 3 hours credit. Prerequisites: AS 3263 and MAT 3243.  
Wave packets, uncertainty principle, Schrodinger equation, one-  
dimensional problems, the hydrogen atom and angular mo-  
momentum.

4283 ELECTROMAGNETIC RADIATION  
(3-0) 3 hours credit. Prerequisite: AS 3283.  
Maxwell's equations, electromagnetic waves, interaction of  
electromagnetic radiation with matter, such as in reflection and  
refraction, waveguides and scattering of plane waves.

4293 FLUID MECHANICS  
(3-0) 3 hours credit. Prerequisites: AS 3273 and MAT 1223.  
Dynamical properties of fluids from basic equations of motion;  
behavior of fluids in actual situations: The atmosphere and the  
ocean.

4323 ACOUSTICS  
(3-0) 3 hours credit. Prerequisites: PHY 1923 and MAT 2213.  
AS 4331 should be taken concurrently.  
Applications of infrasound and ultrasound, including sonar and  
biomedical applications. Noise suppression methods.

4331 ACOUSTICS LABORATORY  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS  
4323.  
Laboratory to accompany AS 4323.

4363 NUCLEAR ENERGY: FISSION AND FUSION  
(3-0) 3 hours credit. Prerequisite: AS 3263.  
Review of the physics of the nucleus. Fission: survey of nuclear  
reactor technology, and consideration of potential hazards  
versus benefits. Fusion: physics of electro-magnetism and sta-  
tistical mechanics necessary to a qualitative understanding of  
the plasma state of matter; current technology surveyed. Com-  
parison with other energy sources.

4373 GENERAL GEOPHYSICS  
(3-0) 3 hours credit. Prerequisites: AS 1002, 1011, PHY 1923 and  
consent of instructor.  
Geomagnetism, gravity, seismology, and heat flow. Interior of  
the earth and tectonics.
4382 EXPLORATION GEOPHYSICS
(2-0) 2 hours credit. Prerequisite: AS 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: AS 4373. Concurrent registration for AS 4382 required; exceptions with consent of instructor. Planning and execution of exploration programs and interpretation of the results of magnetic, gravity and seismic surveying.

4623 COATINGS TECHNOLOGY
(3-0) 3 hours credit. Prerequisite: AS 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: AS 3643 and AS 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 polydiones; 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: AS 4653 or concurrent registration. Laboratory projects illustrating and extending the concepts discussed in AS 4653.

4703 ORGANIC CHEMISTRY OF COATINGS
(3-0) 3 hours credit. Prerequisite: AS 3623. 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: AS 3623. Electrochemical aspects, reaction mechanisms, thermodynamics and kinetics of corrosion processes; prevention of corrosion, cathodic and anodic protection; inhibitors, passivators; coatings.
INDUSTRIAL AND COMMERCIAL APPLICATIONS OF POLYMERS
(3-0) 3 hours credit. Prerequisite: AS 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.

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.

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.

PRACTICUM IN APPLIED SCIENCE
1-3 hours credit. Prerequisite: Consent of Division Director.
A twelve-week summer program of research and/or supervised applications of theory in an industrial environment.

FIELD METHODS IN GEOLOGY
(0-9) 3 hours credit. Prerequisites: AS 1002 and 1011.
Use of surveying methods and topographic and air photo bases for geologic mapping. Description, recording, and interpretation of field relationships.

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

PHYSICS

PRACTICAL PHYSICS
(3-0) 3 hours credit. Prerequisite: High school algebra.
A one-semester course in selected topics of particular interest to personnel in the auxiliary health professions and nursing.
The orientation is towards the practical aspects of physics as may be found in laboratory applications of physics.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1703</td>
<td>PHYSICS OF ENERGY AND THE ENVIRONMENT</td>
<td>(3-0) 3</td>
<td>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.</td>
</tr>
<tr>
<td>1723</td>
<td>LIGHT, COLOR AND PHOTOGRAPHY</td>
<td>(3-0) 3</td>
<td>A non-mathematical study of the basic concepts of optics and their applications in everyday life. Perception of light and color, lasers and other topics of interest to non-scientists, especially artists and photographers, are discussed.</td>
</tr>
<tr>
<td>1803</td>
<td>PHYSICS FOR LIFE SCIENCES I</td>
<td>(3-0) 3</td>
<td>The principles of physics with applications and problem solving useful to biology and pre-medical students. Topics are mechanics and wave phenomena.</td>
</tr>
<tr>
<td>1811</td>
<td>PHYSICS FOR LIFE SCIENCES I LABORATORY</td>
<td>(0-3) 1</td>
<td>Laboratory to accompany PHY 1803.</td>
</tr>
<tr>
<td>1823</td>
<td>PHYSICS FOR LIFE SCIENCES II</td>
<td>(3-0) 3</td>
<td>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.</td>
</tr>
<tr>
<td>1831</td>
<td>PHYSICS FOR LIFE SCIENCES II LABORATORY</td>
<td>(0-3) 1</td>
<td>Laboratory to accompany PHY 1823.</td>
</tr>
<tr>
<td>1903</td>
<td>TECHNICAL PHYSICS I</td>
<td>(3-0) 3</td>
<td>The basic concepts and methods of physics. Topics are mechanics and wave phenomena.</td>
</tr>
<tr>
<td>1911</td>
<td>TECHNICAL PHYSICS I LABORATORY</td>
<td>(0-3) 1</td>
<td>Laboratory to accompany PHY 1903.</td>
</tr>
<tr>
<td>1923</td>
<td>TECHNICAL PHYSICS II</td>
<td>(3-0) 3</td>
<td>The latter may be taken concurrently.</td>
</tr>
</tbody>
</table>
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.

3103 OUTER SPACE: FRONTIER OR CURIOSITY?  
(3-0) 3 hours credit. Prerequisite: Upper-division standing.  
Brief history including recent Pioneer fly-bys, quasars, black holes and neutron stars. Implications for man, his nature and place therein. Science fiction and outer space; extra terrestrial life.

3403 PHYSICS FOR MEDICAL TECHNOLOGY  
(3-0) 3 hours credit. Prerequisite: Working knowledge of high school algebra.  
A one-semester course primarily for students in the medical technology program. Areas of physics covered are electricity and magnetism, electric circuits, electronics and optics. PHY 3411 should be taken concurrently.

3411 PHYSICS FOR MEDICAL TECHNOLOGY LABORATORY  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment in PHY 3403.  
Laboratory to accompany PHY 3403.

4103 CLASSICAL CONCEPTS IN PHYSICS  
(3-0) 3 hours credit. Prerequisite: PHY 1923.  
Framework of mechanics, thermodynamics and electromagnetism studied with attention to historical and philosophical aspects. Some applications are considered.

COURSE DESCRIPTIONS  
ASTRONOMY  

(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.
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 128.\(^\text{34}\) All candidates for the degree must complete:

A. 39 semester hours in Chemistry, 26 of which must be at the upper-division level.
   1. 31 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 4923 Special Project in Chemistry
   
   2. 8 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:
      
      PHY 1903 Technical Physics I  
      PHY 1911 Technical Physics I Laboratory  
      PHY 1923 Technical Physics II  
      PHY 1931 Technical Physics II Laboratory  
      MAT 1213 Calculus I  
      MAT 1223 Calculus II

   C. 10 semester hours of free electives.

      MAT 2213 Calculus III or

\(^{34}\)Thirty-nine of the total semester hours required for the degree must be at the upper-division level.
CS 1723 Information Structures I

CS 1713 Introduction to Computer Science

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

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 INTRODUCTORY CHEMISTRY LABORATORY
(0-3) 1 hour credit. Prerequisite or concurrent enrollment in CHE 1103.
An introduction to the basic operations of the chemical laboratory with examples chosen from inorganic chemistry. This course is designed for dental auxiliary students and physical therapists; it 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 and is strongly recommended for students planning advanced course work in chemistry.

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, fermentation, etc. 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.

2093 INTRODUCTION TO INFORMATION SCIENCE
(3-0) 3 hours credit. Prerequisites: CHE 2003 and CS 1711.
A survey of information science and its methods, the information science concept, major manual and computer-based systems, and the relevance of information science methods to physical science needs.

2103 ELEMENTARY ORGANIC AND BIOCHEMISTRY
(3-0) 3 hours credit. Prerequisite: CHE 2103 or consent of instructor. 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; polyfunctional organic compounds; including an introduction to biochemistry. A continuation of CHE 2203.

3012 ORGANIC QUANTITATIVE ANALYSIS (0-6) 2 hours credit. Prerequisite: CHE 2212; CHE 3003 or concurrent registration; or consent of instructor.
Continuing laboratory study of quantitative analysis of organic reactions, multi-step synthetic procedures, and molecular structure; qualitative and quantitative use of infrared, ultraviolet, and proton nuclear magnetic resonance spectrometry; introduction to mass spectrometry.

3143 MEDICINAL CHEMISTRY, PHARMACOLOGY AND FOLKLORE MEDICINE (3-0) 3 hours credit. Prerequisites: CHE 3003 and CHE 3012. Primarily for science majors.
Lecture/seminar course which provides in-depth examination of selected examples of naturally occurring drugs (alkaloids, terpenoids, and other natural products), their sources, modes of physiological activity and active analogues.

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 photochemistry. 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. Prerequisite: 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. Prerequisite: 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. Prerequisite: 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 3003 and CHE 3203; 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.

3423 INFORMATION SOURCES
(3-0) 3 hours credit. Prerequisite: CHE 2093.
A survey of reference and bibliographic sources for the physical sciences: catalogs and indexing; abstracting services for books, journals, documents and technical reports; bibliographic controls of the scientific literature.

3953 INTRODUCTION TO RESEARCH TECHNIQUES
(1-6) 3 hours credit. Prerequisite: Upper-division standing and consent of instructor.
Practical introduction to techniques and methodology of chemical research.
4223 ADVANCED BIOCHEMISTRY
(3-0) 3 hours credit. Prerequisite: BIO 3513, 3521 and CHE 3003, 3012.
Chemical aspects of regulation and control mechanisms; membrane-related phenomena; oxidative phosphorylation and photosynthesis; 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.

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 I
(3-0) 3 hours credit. Prerequisite: CHE 3203.
A study of the elements and their periodic properties; acid-base theory, crystalline state, coordination chemistry, non-aqueous solvents and other advanced topics.

4273 INORGANIC CHEMISTRY II
(3-0) 3 hours credit. Prerequisite: CHE 4263 or consent of instructor.
An advanced study of atomic and molecular structure, ionic crystals, metal complexes, acid-base theory and other subjects. A continuation of CHE 4263.

4282 INORGANIC PREPARATIONS
(0-6) 2 hours credit. Prerequisite: CHE 3232 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.

4311 GLASSBLOWING
(0-3) 1 hour credit. Prerequisite: CHE 2212, CHE 3203, and consent of the instructor.
Techniques used in constructing glass scientific apparatus.

4321 CHEMICAL LITERATURE
(1-0) 1 hour credit. Prerequisite: CHE 3003 and CHE 3203.
A survey of important chemical reference works and periodicals and practice in their use.

4343 QUANTUM CHEMISTRY
(3-0) 3 hours credit. Prerequisite: MAT 3243; CHE 4253 or AS 4263 or concurrent registration with either of these; or consent of instructor.
Electronic structure of atoms and molecules, ab initio and semi-empirical methods, variational and perturbation techniques, time dependent perturbations, optical transitions in atoms and molecules.

4372 EXPLORATION GEOCHEMISTRY
(2-0) 2 hours credit. Prerequisite: CHE 3373.
Principles and methods of geochemical prospecting. Trace element analysis.

4402 ABSTRACTING AND INDEXING
(2-0) 2 hours credit. Prerequisite: CHE 3423.
A survey of abstracting and indexing methods, automatic indexing technology, effectiveness of indexing; the indexing thesauri and their construction.

4413 PATENT SEARCH AND PREPARATION
(3-0) 3 hours credit. Prerequisite: CHE 3423.
National systems for patent control; retrieval of patent information in science and technology. Patentability, the legal environment, preparation of patent applications.

4503 WATER AND WASTEWATER TREATMENT
(3-0) 3 hours credit. Prerequisites: CHE 2003 and AS 4293 or consent of the instructor.
The application of chemical, biochemical, physical and mathematical processes to water treatment, wastewater treatment and pollution control. Recommended for students contemplating an engineering degree.

4911-3 INDEPENDENT STUDY
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 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. Prerequisite: CHE 3003 and CHE 3203. Oral reports on current publications in chemistry and chemical technology. May be repeated for credit when topics vary, with consent of the Division Director.

DIVISION OF MATHEMATICS, COMPUTER SCIENCE, AND SYSTEMS DESIGN

The aim of the Division of Mathematics, Computer Science, and Systems Design is to give the student a broad foundation of knowledge across the areas of mathematics, statistics, and computer science.

The Division offers a Bachelor of Science Degree in Mathematics, Computer Science, and Systems Design. Courses, in addition to those required for the degree, may be chosen so that 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, 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

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.

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 and/or MAT 1092, Elementary Functions.
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; re­
lations, functions, graphing functions. Credit cannot be earned
for both MAT 1011 and MAT 1143.

1022 FUNDAMENTALS OF CALCULUS
(2-0) 2 hours credit. Prerequisite: MAT 1011.
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. Credit cannot be
earned for both MAT 1022 and MAT 1143.

1031 APPLIED LINEAR ALGEBRA
(1-0) 1 hour credit. Prerequisite: MAT 1011.
Systems of linear equations, solution by elimination; systems of
linear inequalities; introduction to linear programming, vectors
and matrices, determinants, inverses of matrices, applications.
Credit cannot be earned for both MAT 1031 and CS 1054.

1051 PROBABILITY AND FINITE MATH
(1-0) 1 hour credit. Prerequisite: MAT 1011.
Events; sample spaces, partitioning the sample space; probability
functions; probabilities of events; calculating probabilities, con­
ditional probabilities and independent events; relative frequency
interpretation of probability. Credit cannot be earned for both
MAT 1051 and MAT 1153.

1062 STATISTICS
(2-0) 2 hours credit. Prerequisite: MAT 1051.
Relative frequency interpretation of probability and related
notions such as distribution functions; random variables; ex­
pected values; descriptive statistics; some common distributions;
the binomial, Poisson, normal and sampling distributions from the
normal; interval estimates; tests of hypotheses. Credit cannot
be earned for both MAT 1062 and MAT 1153.

1092 ELEMENTARY FUNCTIONS
(2-0) 2 hours credit. Prerequisite: MAT 1011 or the equivalent.
Polynomial and rational functions, exponential functions, logar­
ithmic functions, trigonometric functions, functions of several
variables.

1103 CONSUMER MATHEMATICS
(3-0) 3 hours credit.

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A course designed to give the necessary mathematical tools for coping with modern 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.

1143 ALGEBRA AND CALCULUS FOR BUSINESS
(3-0) 3 hours credit.
Aspects of college algebra and calculus for business application. Includes: exponents; arithmetic and factorization of polynomials; rational expressions; negative and rational exponents; linear equations; relations; functions; graphing functions; 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; definite integrals and application. Credit may not be earned for both MAT 1011 and MAT 1143, nor can it be earned for both MAT 1022 and MAT 1143.

1153 INTRODUCTORY PROBABILITY AND STATISTICS
(3-0) 3 hours credit.
Events, sample spaces, partitioning the sample space; probability functions; probabilities of events; calculating probabilities, conditional probabilities and independent events; relative frequency interpretation of probability. 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. Credit cannot be earned for both MAT 1051 and MAT 1153 nor can it be earned for both MAT 1062 and 1153.

1213 CALCULUS I
(3-0) 3 hours credit. Prerequisites: MAT 1011 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.

2013 STATISTICAL METHODS IN THE LIFE AND SOCIAL SCIENCES I
(3-0) 3 hours credit. Prerequisite: MAT 1153.
Open to students from all disciplines. Analysis of frequency data, simple linear regression, one-way analysis of variance and other simple linear models. Use of packaged programs.

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.

2923 MATHEMATICS OF FINANCE
(3-0) 3 hours of credit. Prerequisite: MAT 1153.
Theory of rates of interest, discount, present value, annuities. Determination of prices and value of mortgages, bonds, shares of stock.

3013 STATISTICAL METHODS IN THE LIFE AND SOCIAL SCIENCES II
(3-0) 3 hours credit. Prerequisites: MAT 2013 and CS 1713 or CS 1073.
An introduction to multivariate statistical methods; the multivariate normal distribution; tests concerning means; multivariate analysis of variance; principal components and factor analysis; use of existing computer program packages in analyzing multivariable data. Emphasis on applications and examples in the life and social sciences.

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, complex variables.

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\textsuperscript{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.
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 Berstein Polynomial Theorem,
Stone-Weierstrass Theorem and the derivative in Rp.

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 R and
Rp.

4233 MODERN ABSTRACT ALGEBRA I
(3-0) 3 hours credit. Prerequisite: MAT 2213. MAT 3233 recom­
mended.
An in-depth study of groups and rings.

4243 MODERN ABSTRACT ALGEBRA II
(3-0) 3 hours credit. Prerequisite: MAT 4233.
Topics in field theory and vector spaces.

4253 NUMBER THEORY
(3-0) 3 hours credit. Prerequisite: MAT 2213.
The theory of primes, congruences and related 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 3523.
Basic tools, simple random sampling, stratified random sam­
ping, ratio and regression estimates, systematic sampling,
cluster sampling, unequal probability sampling, two-stage and multistage sampling, non-sampling errors.

4523 STATISTICAL DESIGN OF EXPERIMENTS
(3-0) 3 hours credit. Prerequisite or corequisite: MAT 3523. Concepts of randomization, replication, orthogonality, blocking, confounding, transformations; various designs such as completely randomized blocks, latin squares, balanced incomplete block, factorial and fractional factorial especially $2^k$ and $2^{k-b}$ designs.

4533 NON-PARAMETRIC STATISTICAL METHODS
(3-0) 3 hours credit. Prerequisite or corequisite: MAT 3523. A survey of non-parametric methods; order statistics, tests based on runs, goodness of fit tests, one sample, two sample and paired sample techniques, location and scale tests.

4543 INTRODUCTION TO STOCHASTIC PROCESSES
(3-0) 3 hours credit. Prerequisite: MAT 3513. An introduction to the theory and applications of stochastic processes with emphasis on Markov processes.

4553 INTRODUCTION TO MULTIVARIATE-STATISTICAL ANALYSIS
(3-0) 3 hours credit. Prerequisites: MAT 3523 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 3523. 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.
1043 INTRODUCTORY COMPUTER PROGRAMMING FOR BUSINESS APPLICATIONS
(2-2) 3 hours credit. Prerequisite: MAT 1011.
Introductory programming. Sorting and ranking; plotting; inventory control. Credit cannot be earned for both CS 1043 and CS 1054.

1054 LINEAR ALGEBRA AND PROGRAMMING FOR BUSINESS
(3-2) 4 hours credit. Prerequisite: MAT 1011 or MAT 1143.
Systems of linear equations, solution by elimination; systems of linear inequalities; introduction to linear programming, vectors and matrices, determinant, inverses of matrices, applications. Introductory programming for business applications; sorting and ranking; plotting; inventory control. Credit cannot be earned for both MAT 1031 and CS 1054 nor can credit be earned for both CS 1043 and CS 1054 or for CS 1054 and CS 1073.

1073 INTRODUCTORY COMPUTER PROGRAMMING FOR SCIENTIFIC APPLICATIONS
(2-2) 3 hours credit. Prerequisite: MAT 1011.
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.
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.
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.

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 HEURISTIC PROGRAMMING AND 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.
The 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.
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 3723.
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.

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 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.

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.

2835 DIGITAL CIRCUITS DESIGN II
(3-4) 5 hours credit. Prerequisite: SD 2815.

2853 DATA ACQUISITION
(2-2) 3 hours credit. Prerequisite: CS 1713.
Operating characteristics of digital-to-analog and analog-to-digital converters. Programming techniques used to interface a minicomputer to scientific laboratory instrumentation.

2873 REAL-TIME PROCESS CONTROL
(2-2) 3 hours credit. Prerequisite: SD 2853.
Operating principles of real-time disk operating systems for minicomputers. Programming techniques for on-line interactive data acquisition, monitoring, and process control applications.

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 processor 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 2853, 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 2873.
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, queueing 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 teaching. 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. 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 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.