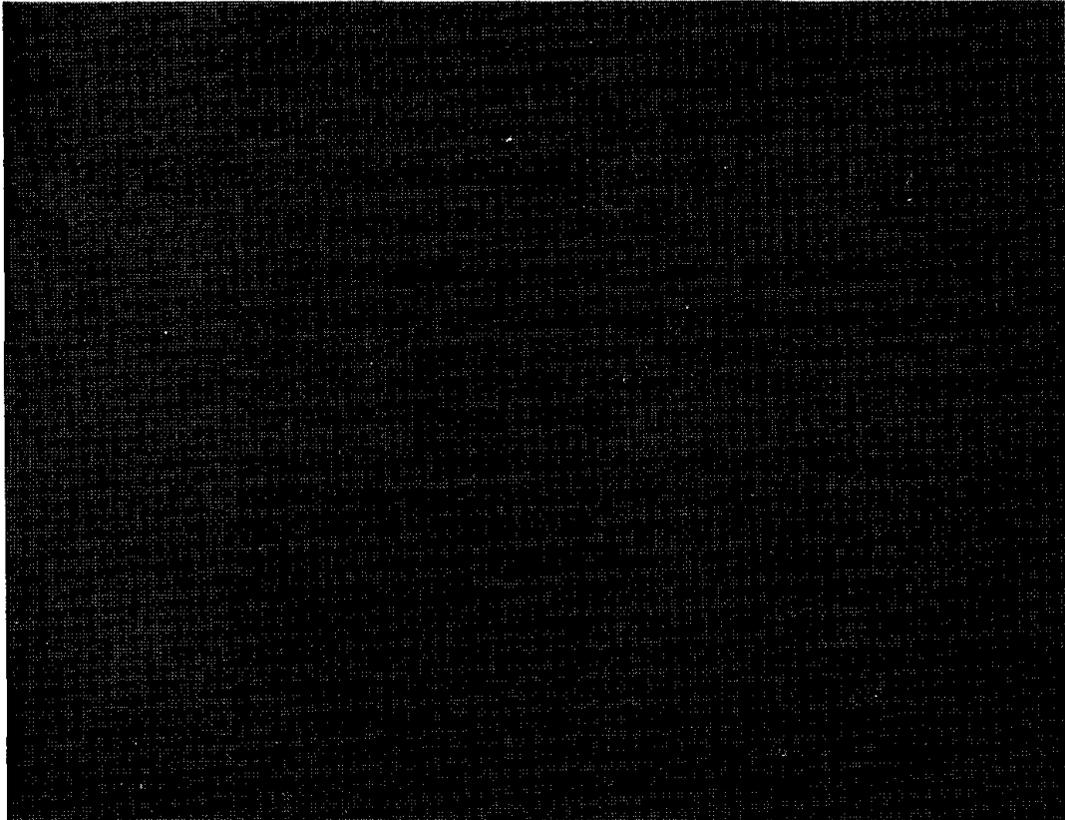


College of Sciences and Mathematics

It is the intent of the College of Sciences and Mathematics to offer degree programs providing education in the theoretical foundations of each discipline while stressing applied aspects. This duality in purpose reflects the creative tension which exists between inwardly directed and applied science. It also attempts to speak to the needs of the community in which The University is located. Thus, the College has a strong technical and career thrust preparing students as mathematics and science teachers, medical laboratory technicians, industrial chemists and physi-



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, veterinary school and schools of allied health. Work-study positions are available, and special attention is given to students transferring into the program from area two-year colleges at the beginning of the junior year. A special program for majors also is being planned in cooperation with other Divisions in which students can develop considerable practical laboratory skills by the beginning of the junior year.

General Education Courses

The following courses are especially designed to satisfy The University's General Education Requirements: BIO 1012, 1021, 1033, 1041, 1052, 1061, 2043, 2053, 3042, 3051, 4073, 4083.

A number of course sequences may be designed from these listings and those from other Divisions:

- 1) BIO 1012 Life and Living Systems
BIO 2053 Man and His Environment
BIO 4073 Law, Ethics and the Life Sciences
- 2) BIO 1012 Life and Living Systems
or
BIO 1103 Principles of Biology (see below)
BIO 1033, 1041 Human Biology, Anatomy and
Physiology
BIO 1052, 1061 Introductory Microbiology
- 3) BIO 1012 Life and Living Systems
BIO 4073 Law, Ethics and the Life Sciences
BIO 4083 Heredity, Evolution, Race and Society

- 4) **BIO 1012 Life and Living Systems**
CHE 1103 Introductory Chemistry
BIO 2053 Man and His Environment

In addition, the following courses designed for majors may be used to fulfill the General Education Requirements: BIO 1103, 1111, 1213, 2313. Other courses in the life science curriculum are also suitable, provided the student has the required prerequisites to elect them. This sequence is recommended for students who are undecided about a major in Life Sciences. If a major is later declared, all of these courses apply to the major and the student then would elect the two laboratories (BIO 1221 and BIO 2321) that accompany Principles of Environmental Biology (BIO 1213) and Genetics (BIO 2313).

BACHELOR OF SCIENCE DEGREE IN BIOLOGY

Entering freshmen intending to major in Biology are required to take the College Board Achievement Test in Biology for placement in Principles of Biology (BIO 1103). Students with a limited knowledge of biology are expected to enroll in Life and Living Systems (BIO 1012) to provide additional background in the life sciences, prior to taking Principles of Biology (BIO 1103).

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.*

The major in Biology consists of 40 semester hours of Biology course work, 20 of which are in the Biology Core Curriculum (BIO 1103, 1111, 1213, 1221, 2313, 2321, 3413, 3421, 3513, 3521). It is expected that the student, in consultation with his Advisor, will concentrate on one of the many special areas of modern biology.

The following courses from other Divisions of the College are *prerequisites for the Biology major*:

- 1) Chemistry: CHE 1103 Introductory Chemistry
CHE 1203 Principles of Chemistry
CHE 1212 Analytical Chemistry I
CHE 2212 Analytical Chemistry II
CHE 2203 Organic Chemistry I (one semester)

An additional semester of organic chemistry is strongly recommended, as is physical chemistry for students interested in biochemistry and molecular aspects of biology.

- 2) Six hours of mathematics are required, including at least one semester of calculus or statistics. One of the following mathematics options is recommended:

- (a) Biostatistics: MAT 1062 Statistics
MAT 2013 Statistical Methods in Life and Social Sciences I

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

From one to three hours of mathematics prerequisites are required for these courses according to the background of the student (MAT 1011, 1031, 1051).

(b) Biomathematics: MAT 1213, 1223 Calculus I and II
MAT 1011 Algebra and MAT 1092
Trigonometry are prerequisites

(c) Statistics and Computer Science:
MAT 1062 Statistics
and one of the following:
MAT 1073 Introductory Computer
Programming for Numerical Applications *or*
MAT 1713 Introduction to Computer
Science
MAT 1011 Algebra and MAT 1051
Probability and Finite Math are
prerequisites

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

Biology electives. At least 8 hours of the 20 hours of electives in biology must be at the upper-division level. Electives may be selected (in consultation with the student's Advisor) from any of the biology courses offered other than those for non-majors.

The remaining hours to complete the 126 semester hours required for the degree are free electives which the student may select from throughout The University.

PREPROFESSIONAL COURSES OF STUDY IN THE HEALTH FIELDS

The University of Texas at San Antonio does not offer specific premedical, pre dental, or pre nursing degree programs; rather preprofessional courses of study to prepare students for admission to medical, dental, and nursing school are available. Admission requirements for those professional schools are outlined in Appendix B. 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 UT San Antonio.

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 is planning a full program of training in the Allied Health area in cooperation with area health institutions and The University of Texas Health Science Center.

BACHELOR OF SCIENCE DEGREE IN MEDICAL TECHNOLOGY

The medical technologist is an important member of an increasingly complex and interrelated health team that is involved in the diagnosis and treatment of disease. The medical technologist performs laboratory tests, supervises medical technicians, and helps to develop new laboratory techniques. A thorough understanding of the basic and applied sciences is necessary in order to utilize complex equipment, perform intricate techniques, and make important judgments. The programs consist of three years of academic work and twelve months of training in an approved School of Medical Technology, and leads to the Bachelor of Science Degree in Medical Technology. The three academic years are designed to give a theoretical basis for analytical procedures, and the one-year internship provides for the specialized application of this knowledge. Basic and applied science courses are integrated with required and elected courses in the liberal arts in order to provide a well-balanced education.

Graduates are prepared for positions in hospital and private clinical laboratories, federal, state, and local health departments, research laboratories of medical schools and research institutions, and physicians' offices.

Degree Requirements

The Board of Schools of the American Medical Association and the American Society for Clinical Pathologists have stipulated that students accepted into approved Schools of Medical Technology must be eligible for a baccalaureate degree at the completion of the one-year clinical training period.

The program described here (three years—110 semester hours of academic training) provides a training program more rigorous than that required to obtain admission to Schools of Medical Technology. Competition is keen for places in the select schools.

The twelve months of training must be carried out in a school approved by the Board of the American Society for Clinical Pathologists and the Board of Schools of the American Medical Association. Close ties have been developed between The University and UT Health Science Center and area hospitals where the final clinical year of training may be carried out. The student, in consultation with his Advisor, should apply to these (or other) Schools of Medical Technology at the beginning of upper-division study.

Certification as a Medical Technologist (A.S.C.P.) is obtained by examination by the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists.

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 126,* including a one-year clinical training period equivalent to 16 semester hours.

All candidates for the degree must complete:

- A. 60 semester hours in the *major*, 27 of which must be at the upper-division level.

Required are:

2 semester hours of mathematics beyond the General Education Requirements. The total of 6 hours in mathematics (4 from the General Education Requirements and 2 for the major) must be beyond the college algebra level.

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

4 semester hours of biological applications of physics.
16 semester hours of chemistry including:

- a) Introductory chemistry
- b) Organic chemistry
- c) Quantitative analytical chemistry

32 semester hours of biology including:

- a) Principles of Biology (BIO 1103, 1111)
- b) Genetics (BIO 2313, 2321)
- c) Mammalian Physiology (BIO 3433, 3441)
- d) Microbiology (BIO 3713, 3721)
- e) Parasitology (BIO 4763, 4771)
- f) Immunology or Virology (BIO 4743, 4751 or BIO 4723, 4731).
- g) Pathogenic Microorganisms (BIO 4783, 4791)
- h) Biochemistry (BIO 3513, 3521)

6 semester hours of medical technology including:

- a) Introduction to the Clinical Laboratory (BIO 1071)
- b) Clinical Microscopy (BIO 2012)
- c) Introductory Pathology (BIO 3011, 3021)
- d) Introduction to Automated Analysis (BIO 3031)

B. A 12 month clinical training period equivalent to 16 semester hours.

COURSE DESCRIPTIONS

BIOLOGY (BIO)

1012 LIFE AND LIVING SYSTEMS

(2-0) 2 hours credit. May not be applied to a major in biology.
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

(0-2) 1 hour credit. May not be applied to a major in biology.
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: College biology or consent of instructor. May not be applied to a major in biology.
Primarily for pre-nursing students. The structure of human muscular, skeletal, nervous and organ systems as related to function.

- 1041 ANATOMY AND PHYSIOLOGY LABORATORY
(0-2) 1 hour credit. May not be applied to a major in biology.
Must be taken concurrently with BIO 1033.
- 1052 INTRODUCTORY MICROBIOLOGY
(2-0) 2 hours credit. Prerequisite: College biology or consent of instructor. May not be applied to a major in biology.
A general study of microorganisms, their characteristics, isolation, growth and importance in nature, industry, public health and human disease. Primarily for pre-nursing students.
- 1061 INTRODUCTORY MICROBIOLOGY LABORATORY
(0-2) 1 hour credit. May not be applied to a major in biology.
Must be taken concurrently with BIO 1052.
- 1071 INTRODUCTION TO THE CLINICAL LABORATORY
(1-0) 1 hour credit. May not be applied to a major in biology.
Investigation of the career possibility in medical technology. Invited lecturers discuss organization and administration of clinical laboratories, medical terminology, collection techniques and safety practices. To be taken both semesters of the freshman year for 1 hour credit per semester.
- 1103 PRINCIPLES OF BIOLOGY
(3-0) 3 hours credit. Prerequisite: High school biology and placement examination.
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.
Must be taken concurrently with BIO 1213 by majors; optional for non-majors.
- 2012 CLINICAL MICROSCOPY
(0-4) 2 hours credit. Prerequisites: BIO 1103, BIO 1111 and introductory chemistry. May not be applied to a major in biology.
Primarily for medical technology students. Laboratory exercises including urine analysis, gastric analysis, stool examination and special tests.
- 2043 NUTRITION
(3-0) 3 hours credit. Prerequisites: BIO 1033 and BIO 1041. May not be applied to a major in biology.

- An examination of human nutritional needs from infancy to adulthood. Primarily for pre-nursing students.
- 2053 **MAN AND HIS ENVIRONMENT**
(3-0) 3 hours credit. Prerequisite: College biology or consent of instructor.
The interaction of man with the eco-system and its consequences.
- 2123 **COMPARATIVE ANATOMY OF VERTEBRATES**
(3-0) 3 hours credit. Prerequisites: BIO 1103 and BIO 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.
- 2143 **COMPARATIVE VERTEBRATE EMBRYOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 1103 and BIO 1111.
Sequential analysis of development in vertebrates and the factors which effect fertilization organogenesis, and implantation with particular reference to the pig, chick and frog.
- 2151 **COMPARATIVE VERTEBRATE EMBRYOLOGY LABORATORY**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 2143.
- 2162 **TISSUE BIOLOGY**
(3-0) 2 hours credit. Prerequisites: BIO 1103 and BIO 1111.
The cytological and histological aspects of cellular organization.
- 2172 **TISSUE BIOLOGY LABORATORY**
(0-4) 2 hours credit.
Must be taken concurrently with BIO 2162.
- 2313 **GENETICS**
(3-0) 3 hours credit. Prerequisites: BIO 1103, BIO 1111, one year of college chemistry and 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.
To be taken concurrently or following BIO 2313.
Optional for non-majors.
- 3011 **INTRODUCTORY PATHOLOGY**
(1-0) 1 hour credit. Prerequisites: BIO 1103, BIO 1111, BIO 3413, and BIO 3421. May not be applied to a major in biology.
Concepts of disease and diagnosis of pathological conditions. Primarily for Medical Technology students.
- 3021 **INTRODUCTORY PATHOLOGY LABORATORY**
(0-2) 1 hour credit. May not be applied to a major in biology. Must be taken concurrently with BIO 3011.

- 3031 INTRODUCTION TO AUTOMATED ANALYSIS**
(0-3) 1 hour credit. Prerequisite: Junior standing or consent of instructor. May not be applied to a major in Biology.
Methods for rapid automated analysis of various enzymes and constituents of body fluids. Primarily for medical technology students.
- 3042 FIELD BIOLOGY AND ECOLOGY**
(2-0) 2 hours credit. Prerequisite: College biology or consent of instructor. May not be applied to a major in Biology.
A study of plants and animals in their natural environment; field trips, collection and analysis of field data are included.
- 3051 FIELD BIOLOGY LABORATORY**
(0-3) 1 hour credit. May not be applied to a major in Biology.
Must be taken concurrently with BIO 3042.
- 3213 ANIMAL ECOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 1213 and BIO 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.
- 3323 EVOLUTION**
(3-0) 3 hours credit. Prerequisite: BIO 2313.
A discussion of theories and possible mechanisms for evolutionary changes at various levels of organization.
- 3413 GENERAL PHYSIOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 1103, BIO 1111 and organic chemistry.
Basic concepts of respiration, photosynthesis, vascular function, endocrine, ion and water balance and other processes in living systems.
- 3421 GENERAL PHYSIOLOGY LABORATORY**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 3413.
- 3433 MAMMALIAN PHYSIOLOGY**
(3-0) 3 hours credit. Prerequisite: BIO 3413, BIO 3421 or consent of instructor.
Physiology of organs and organ systems of vertebrates with primary emphasis on mammals.
- 3441 MAMMALIAN PHYSIOLOGY LABORATORY**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 3433.
- 3513 BIOCHEMISTRY**
(3-0) 3 hours credit. Prerequisites: CHE 2223 and CHE 2232.
A study of molecules found in living cells including carbohydrates, lipids, proteins, enzymes, nucleic acids and their biosynthesis and metabolic reactions. This course may also be taken as CHE 4203.

- 3521 BIOCHEMISTRY LABORATORY**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 3513.
A laboratory study of biochemical compounds. This course may also be taken as CHE 4211.
- 3533 RADIATION BIOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3513 and BIO 3521.
Interactions of ionizing ultraviolet and visible radiations with matter; biological effects; cellular repair of radiation damage; biological photo-receptors.
- 3541 RADIATION BIOLOGY LABORATORY**
(0-1) 1 hour credit.
Must be taken concurrently with BIO 3533.
- 3713 MICROBIOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 1103, BIO 1111, BIO 2313, BIO 2321, BIO 3533, BIO 3541 or concurrently with latter two.
A comprehensive study of microorganisms including their composition, morphology, growth, metabolism, classification, ecology and significance in disease.
- 3721 MICROBIOLOGY LABORATORY**
(0-1) 1 hour credit.
Must be taken concurrently with BIO 3713.
- 3732 INDUSTRIAL MICROBIOLOGY**
(2-0) 2 hours credit. Prerequisites: BIO 3713 and BIO 3721.
A study of fermentations of industrial importance, food processing, and quality control.
- 3741 INDUSTRIAL MICROBIOLOGY LABORATORY**
(0-1) 1 hour credit.
Must be taken concurrently with BIO 3732.
- 3813 CELLULAR BIOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3513 and BIO 3521.
The composition, function and interaction of cellular constituents and substructures at the ultra-structural level.
- 3821 CELLULAR BIOLOGY LABORATORY**
(0-1) 1 hour credit.
Must be taken concurrently with BIO 3813.
- 3831 TISSUE AND ORGAN CULTURE**
(1-0) 1 hour credit. Prerequisites: BIO 3713, 3721, 3513, 3521.
Theoretical and practical aspects of maintaining and growing cells, tissues and organs from various sources.
- 3842 TISSUE AND ORGAN CULTURE LABORATORY**
(0-4) 2 hours credit.
Must be taken concurrently with BIO 3831.
- 4073 LAW, ETHICS AND THE LIFE SCIENCES**
(3-0) 3 hours credit. Prerequisite: College biology or consent of instructor. May not be applied to a major in biology.
An examination of the ethical, philosophical and social implica-

tions 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: College biology or consent of instructor. May not be applied to a major in biology.
A study of variation and evolutionary change in relation to human thought, experience, cultural evolution, diversity and mating systems.
- 4333 **POPULATION GENETICS**
(3-0) 3 hours credit. Prerequisites: BIO 2313 and BIO 2321.
A quantitative approach to the study of genetic systems in populations, including mutations, selection, polymorphism and mating systems.
- 4343 **MOLECULAR GENETICS**
(3-0) 3 hours credit. Prerequisites: BIO 2313, 2321, 3513, and 3521.
Molecular approach to structure, replication, mutation and phenotypic expression of genetic material.
- 4433 **NEUROBIOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3413 and BIO 3421.
Physiology of the sensory receptors and central and peripheral processing of information, including neural and endocrine interrelationships, effects of environmental stimuli on neural systems, and neural correlates of behavior.
- 4443 **ENDOCRINOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3433 and BIO 3441.
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.
- 4523 **INTERMEDIARY METABOLISM**
(3-0) 3 hours credit. Prerequisites: BIO 3513 and BIO 3521.
A detailed consideration of metabolic pathways, energy metabolism and their regulation. This course may also be taken as CHE 4223.
- 4531 **INTERMEDIARY METABOLISM LABORATORY**
(0-1) 1 hour credit.
Must be taken concurrently with BIO 4523.
This course may also be taken as CHE 4231.
- 4543 **BIOCHEMICAL TECHNIQUES**
(0-6) 3 hours credit. Prerequisites: BIO 4523 and BIO 4531.
Laboratory experience in methods of biochemical fractionation, purification and analysis of components.

- 4723 VIROLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3713, 3721, 3513, and 3521.
A study of the diversity of viruses and biochemical mechanisms for their replication.
- 4731 VIROLOGY LABORATORY**
(0-1) 1 hour credit.
Must be taken with or following BIO 4723.
- 4743 IMMUNOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3713, 3721, 3513, and 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**
(0-1) 1 hour credit.
Must be taken with or following BIO 4743.
- 4763 PARASITOLOGY**
(3-0) 3 hours credit. Prerequisites: BIO 3713 and BIO 3721.
A study of the animal parasites of humans and related host 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.
- 4783 PATHOGENIC MICROORGANISMS**
(3-0) 3 hours credit. Prerequisites: BIO 3713 and BIO 3721.
A consideration of medically important microorganisms and their interaction with animal and human hosts.
- 4791 PATHOGENIC MICROORGANISMS LABORATORY**
(0-3) 1 hour credit.
Must be taken concurrently with BIO 4783.
- 4953 SPECIAL STUDIES PROJECT**
(0-6) 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.

DIVISION OF EARTH AND PHYSICAL SCIENCES

The degree options 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 earth science, chemistry or physics. 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 program for majors concentrates much of the specialty in the early years, thereby permitting increased specialization later in the college career.

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 126.* All candidates for the degree must complete:

- A. 31 semester hours of *required* chemistry courses, 13 of which must be at the upper-division level. The courses are:

Introductory Chemistry (CHE 1103)	3 credit hours
Chemical Principles (CHE 1203)	3 credit hours
Organic Chemistry (CHE 2203, 2223)	6 credit hours
Physical Chemistry (CHE 3203, 3223)	6 credit hours
Analytical Chemistry (CHE 1212, 2212, 2232, 3212, 3232)	10 credit hours
Special Studies Project (CHE 4953)	3 credit hours

- B. A minimum of 8 credit hours of *elective* chemistry at the upper-division level selected from:

Biochemistry (CHE 4203, 4211, 4223, 4231)
Inorganic Chemistry (CHE 4263, 4273, 4282)

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

Organic Chemistry (CHE 4243)
Physical Chemistry (CHE 4253)
Nuclear Chemistry and Radioisotope Techniques
(CHE 4293)

C. 28 semester hours of *support work*.

Required courses (20 semester hours) are:

Physics (PHY 1903, 1911, 1923, 1931)	8 credit hours
Calculus (MAT 1213, 1223)	6 credit hours
Advanced Mathematics (MAT 2213 or 1723)	3 credit hours
Introduction to Computer Science (MAT 1713)	3 credit hours

A minimum of an additional 9 hours of *elective support courses*, to be taken from Mathematics and Computer Science, is required.

D. 8 semester hours of *free electives*.

COURSE DESCRIPTIONS

CHEMISTRY

(CHE)

1103 INTRODUCTORY CHEMISTRY

(3-0) 3 hours credit.

An introductory course in chemistry for non-science majors. A placement examination is required.

1123 CHEMISTRY IN SOCIETY

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

An introductory course in chemistry for non-science majors.

1143 CHEMISTRY AND FOLKLORE MEDICINE: THE ALKALOIDS

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

The course will deal with such commonly known drugs as quinine (antimalarial), Rauwolfia serpentina (hypotensive), ergot alkaloids (uterine contracting agents), nicotine (tobacco), vinblastine and vincristine (antileukemic alkaloids), morphine alkaloids (analgesics), anaesthetizing alkaloid Cocaine, psychotomimetic drugs (Mescaline, peyote species), opium alkaloids, ipecac alkaloids (antiamoebics), strychnos alkaloids (arrow poisons).

1153 THE CHEMISTRY OF FASHION

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

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

- 1163 **INTRODUCTORY MARINE CHEMISTRY**
(2-3) 3 hours credit. May not be applied to a major in science.
A general survey of chemical processes in the sea; value, analysis, collection, concentration, refining and uses of sea and seabed minerals.
- 1203 **CHEMICAL PRINCIPLES**
(3-0) 3 hours credit. Prerequisite: CHE 1103. Primarily for science majors.
Development and application of chemical concepts, theories and laws.
- 1212 **ANALYTICAL CHEMISTRY I**
(0-6) 2 hours credit. Prerequisite: CHE 1203 or concurrent registration.
An introductory laboratory course quantitatively illustrating chemical concepts, theories and laws.
- 2103 **ELEMENTARY ORGANIC AND BIOCHEMISTRY**
(3-0) 3 hours credit. Prerequisite: CHE 1123 or CHE 1203. May not be applied to a major in chemistry.
A one semester survey of organic and biochemical structure and reactions.
- 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.
An introductory laboratory course in elementary organic and biochemistry.
- 2203 **ORGANIC CHEMISTRY I**
(3-0) 3 hours credit. Prerequisites: CHE 1203 and CHE 1212. Primarily for science majors.
Fundamentals of structure and reactivity of organic compounds.
- 2212 **ANALYTICAL CHEMISTRY II**
(1-3) 2 hours credit. Prerequisite: CHE 2203 or concurrent registration. Primarily for science majors.
Qualitative and quantitative analysis of organic compounds.
- 2223 **ORGANIC CHEMISTRY II**
(3-0) 3 hours credit. Prerequisites: CHE 2203 and CHE 2212.
Fundamentals of structure and reactivity of organic compounds. For science majors but open to others. A continuation of CHE 2203.
- 2232 **ANALYTICAL CHEMISTRY III**
(1-3) 2 hours credit. Prerequisite: CHE 2212.
Elementary qualitative and quantitative analysis of organic compounds. For science majors but open to others. A continuation of CHE 2212.
- 3203 **PHYSICAL CHEMISTRY I**
(3-0) 3 hours credit. Prerequisites: CHE 2223 or concurrent registration; calculus and 2 semesters of physics.
The chemical thermodynamics of gas and liquid systems, the nature of the chemical bond and other concepts.

- 3212 **ANALYTICAL CHEMISTRY IV**
(1-3) 2 hours credit. Prerequisite: CHE 3203 or concurrent registration.
An experimental study of chemical thermodynamics, bonding and other concepts.
- 3223 **PHYSICAL CHEMISTRY II**
(3-0) 3 hours credit. Prerequisite: CHE 3203.
Studies in reaction kinetics, electrochemistry, molecular structure and other concepts. A continuation of CHE 3212.
- 3232 **ANALYTICAL CHEMISTRY V**
(1-3) 2 hours credit. Prerequisite: CHE 3223 or concurrent registration.
Experimental study of reaction kinetics, electrochemistry, molecular structure and other concepts. A continuation of CHE 3212.
- 4203 **BIOCHEMISTRY I**
(3-0) 3 hours credit. Prerequisites: CHE 2223 and CHE 2232.
This course is offered as BIO 3513 and is described with the Biology course listings.
- 4211 **ANALYTICAL CHEMISTRY VI**
(0-3) 1 hour credit. Prerequisite: CHE 4203 or concurrent registration.
This course is offered as BIO 3521 and is described with the Biology course listings.
- 4223 **BIOCHEMISTRY II**
(3-0) 3 hours credit. Prerequisite: CHE 4203.
This course is offered as BIO 4523 and is described with the Biology course listings.
- 4231 **ANALYTICAL CHEMISTRY VII**
(0-3) 1 hour credit. Prerequisite: CHE 4223 or concurrent registration.
This course is offered as BIO 4531 and is described with the Biology course listings.
- 4243 **ORGANIC CHEMISTRY III**
(3-0) 3 hours credit. Prerequisites: CHE 2223 and CHE 2232.
An advanced organic chemistry. A continuation of CHE 2223.
- 4253 **PHYSICAL CHEMISTRY III**
(3-0) 3 hours credit. Prerequisites: CHE 3223 and CHE 3232.
An advanced physical chemistry; a continuation of CHE 3223.
- 4263 **INORGANIC CHEMISTRY I**
(3-0) 3 hours credit. Prerequisite: CHE 3212.
A survey of the discovery and periodic properties of the elements.
- 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.

4282 INORGANIC PREPARATIONS

(0-6) 2 hours credit. Prerequisite: CHE 3232 or consent of instructor.

A laboratory study of inorganic structure and complex ion formation.

4293 NUCLEAR CHEMISTRY AND RADIOISOTOPE TECHNIQUES

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

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

4301 ANALYTICAL CHEMISTRY VIII

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

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

4953 SPECIAL STUDIES PROJECT

(0-6) 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.

BACHELOR OF SCIENCE DEGREE IN PHYSICS

The minimum number of semester hours required for this degree, including the 50 hours of General Education Requirements, is 129.* All candidates for the degree must complete:

- A. 19 semester hours of *required* courses in the *major*, 11 of which must be at the upper-division level. The courses are:

Technical Physics I and II (PHY 1903, 1923)	6 credit hours
Technical Physics Laboratory I and II (PHY 1911, 1931)	2 credit hours
Electronics (PHY 3704)	4 credit hours
Microphysics (PHY 3723)	3 credit hours
Experimental Physics I and II (PHY 3822, 3842)	4 credit hours

- B. A minimum of 11 semester hours of *elective* physics courses, all of which must be at the upper-division level. These courses are to be chosen in consultation with an Advisor in the Division of Earth and Physical Sciences and approved by the Division Director.

- C. 29 semester hours of *support* work.

Required courses (17 semester hours) are:

Chemistry (CHE 1103, 1203 and 1212)	8 credit hours
Mathematics (MAT 1213, 1223 and 1713)	9 credit hours

A minimum of an additional 12 credit hours of *elective support* courses, at least 3 of which must be upper-division, to be chosen in consultation with an Advisor in the Division of Earth and Physical Sciences, is required. Support areas are biology, chemistry, mathematics and systems design.

- D. 20 semester hours of *free electives*.

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

A student majoring in physics may elect to pursue one of the following options: applied physics, biophysics, pre-medicine, or professional physics. Students electing the biophysics and pre-medical options will be advised to use some of their free electives for additional biology and chemistry courses other than those already specifically listed. The applied option generally requires additional chemistry and mathematics courses. The professional option, for students intending to pursue an advanced degree in physics, requires considerable additional physics and mathematics courses. At least 40 total credit hours in physics is recommended in this later option.

COURSE DESCRIPTIONS

PHYSICS

(PHY)

1703 PHYSICS OF ENERGY AND THE ENVIRONMENT

(3-0) 3 hours credit.

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

1713 PHYSICS OF THE SEA AND THE COAST

(3-0) 3 hours credit. Prerequisite: high school algebra.

Phenomena are described and explanations evolved bringing out underlying physical principles. Major subdivisions of phenomena to be studied are: bulk properties of sea water, waves, tides, air-sea interactions, currents. Practical applications are discussed. Use of mathematics is limited.

1723 LIGHT, COLOR AND PHOTOGRAPHY

(3-0) 3 hours credit.

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.

1803 PHYSICS FOR LIFE SCIENCES I

(3-0) 3 hours credit. Prerequisite: working knowledge of high school algebra.

The principles of physics with applications and problem solving useful to biology and pre-medical students.

Topics are: mechanics, properties of matter, including fluid mechanics, waves and acoustics. PHY 1811 must be taken concurrently unless already passed.

1811 PHYSICS FOR LIFE SCIENCES I LABORATORY

(0-3) 1 hour credit.

Experiments primarily in mechanics, fluids and waves. To be taken with PHY 1803.

- 1823 PHYSICS FOR LIFE SCIENCES II**
 (3-0) 3 hours credit. Prerequisite: PHY 1803.
 A continuation of Physics for Life Sciences I.
 Topics are: electricity, magnetism, optics, atomic and nuclear physics. PHY 1831 must be taken concurrently unless already passed.
- 1831 PHYSICS FOR LIFE SCIENCES II LABORATORY**
 (0-3) 1 hour credit.
 Continuation of PHY 1811. Experiments primarily are in optics, electricity, magnetism and modern physics. To be taken with PHY 1823.
- 1903 TECHNICAL PHYSICS I**
 (3-0) 3 hours credit. Prerequisites: MAT 1213 or concurrent registration and PHY 1911 or concurrent registration.
 The basic concepts of physics and techniques of problem solving needed for succeeding courses. Material covered is in classical and relativistic mechanics, waves and sound. This is not a survey nor a terminal course.
- 1911 TECHNICAL PHYSICS I LABORATORY**
 (0-3) 1 hour credit.
 Experiments primarily in mechanics and waves. To be taken with PHY 1903.
- 1923 TECHNICAL PHYSICS II**
 (3-0) 3 hours credit. Prerequisites: PHY 1903, MAT 1223 or concurrent registration, and PHY 1931 or concurrent registration.
 A continuation of Technical Physics I. Material covered is in electricity, magnetism, optics and modern physics.
- 1931 TECHNICAL PHYSICS II LABORATORY**
 (0-3) 1 hour credit.
 Experiments primarily in electricity, magnetism, optics and modern physics. To be taken with PHY 1923.
- 3704 ELECTRONICS**
 (3-3) 4 hours credit. Prerequisite: working knowledge of high school algebra. Some college physics is also desirable.
 Introduction to d.c. and a.c. circuits, electronic components and their uses in basic circuits for instrumentation commonly encountered in the scientific laboratory.
- 3723 MICROPHYSICS**
 (3-0) 3 hours credit. Prerequisites: PHY 1923 and MAT 1223.
 Atomic-, molecular-, nuclear-, and solid-state-physics: their basic concepts, principles and applications are presented.
- 3743 PHYSICAL MECHANICS**
 (3-0) 3 hours credit. Prerequisites: PHY 1923 and MAT 1223.
 Kinematics and dynamics of a particle, systems of particles, central force motion, rigid body motion in a plane, accelerated reference frames.

- 3763 ELECTRICITY AND MAGNETISM**
 (3-0) 3 hours credit. Prerequisites: PHY 1923, MAT 2223 or concurrent registration.
 Electrostatics, currents, magnetic fields, introduction to Maxwell's equations.
- 3783 WAVE MOTION**
 (3-0) 3 hours credit. Prerequisites: MAT 2213 plus one of the following: PHY 3743, PHY 3763.
 The essential features of wave motion, unifying material primarily from acoustics and physical optics. Some of the topics considered are: derivation of the classical wave equation and its one-dimensional solution, super-position, interference, energy content of waves, doppler effect, polarization, coherence, diffraction.
- 3803 THERMODYNAMICS AND STATISTICAL MECHANICS**
 (3-0) 3 hours credit. Prerequisites: PHY 1203, PHY 1923 and MAT 2213.
 Heat, the kinetic theory of gases, the laws of thermodynamics, elements of statistical mechanics.
- 3822 EXPERIMENTAL PHYSICS I**
 (1-3) 2 hours credit. Prerequisite: PHY 1923.
 Experiments mostly in optics, acoustics, solid-state physics and x-rays. The purpose is to familiarize the student with apparatus and techniques common to many research laboratories.
- 3842 EXPERIMENTAL PHYSICS II**
 (1-3) 2 hours credit. Prerequisites: PHY 3723 and PHY 3822.
 Designed to follow Experimental Physics I. The experiments are mostly in x-rays and nuclear physics.
- 3862 EXPERIMENTAL PHYSICS III**
 (1-3) 2 hours credit. Prerequisites: PHY 3842 or consent of instructor and PHY 3723.
 Experiments in atomic and nuclear physics. Emphasis is on considerable student independence in performing experiments.
- 3883 BIOPHYSICS I**
 (3-0) 3 hours credit. Prerequisites: CHE 1203, PHY 1923 and MAT 1223.
 Study of biological systems from the physicist's point of view. Topics are: introduction to atomic structure, molecular bonds, concepts of molecular biophysics, macromolecules, interaction of radiation with biological materials.
- 3893 BIOPHYSICS II**
 (3-0) 3 hours credit. Prerequisite: PHY 3883.
 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 some thermodynamics of living systems.

- 4703 DYNAMICS**
 (3-0) 3 hours credit. Prerequisites: PHY 3743, MAT 2223 and MAT 3123.
 An introduction to Lagrangian and Hamiltonian methods, motion of a rigid body in three dimensions, and small oscillations.
- 4723 ELECTROMAGNETIC RADIATION**
 (3-0) 3 hours credit. Prerequisites: PHY 3763 and MAT 3123.
 Maxwell's equations, electromagnetic waves, interaction of electromagnetic radiation with matter such as in reflection and refraction, waveguides and scattering of plane waves.
- 4743 FLUID MECHANICS**
 (3-0) 3 hours credit. Prerequisites: PHY 3743, MAT 2223 and MAT 3123.
 Dynamical properties of fluids from basic equations of motion; behavior of fluids in actual situations: the atmosphere and the ocean.
- 4763 INTRODUCTION TO QUANTUM MECHANICS**
 (3-0) 3 hours credit. Prerequisites: PHY 3723 and MAT 2223.
 Wave packets, uncertainty principle, Schrodinger equation, one-dimensional problems, the hydrogen atom, and angular momentum.
- 4783 NUCLEAR PHYSICS**
 (3-0) 3 hours credit. Prerequisite: PHY 3723.
 Radioactivity, nuclear reactions, nuclear properties, survey of nuclear models, elementary particles.

COURSE DESCRIPTIONS

ASTRONOMY

(AST)

- 1013 INTRODUCTION TO ASTRONOMY I**
 (3-0) 3 hours credit.
 A descriptive course including the development of astronomy, 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 may be 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 accompanying AST 1023.

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 math, statistics, computer science, or any combination thereof.

Beyond the required hours, the student is free to choose any collection of courses from within The University to build a meaningful interdisciplinary degree. The Division recommends that at least two of the following sequences be taken by the science-oriented student: Technical Physics I and II (PHY 1903, 1911 and PHY 1923, 1931); Introductory Chemistry (CHE 1103) and Chemical Principles (CHE 1203); Principles of Biology (BIO 1103); and Principles of Environmental Biology (BIO 1213) or Genetics (BIO 2313) or Tissue Biology (BIO 2162). Recommendation for meaningful sequences in environmental studies and social science can be obtained upon request from the Division of Mathematics, Computer Science, and Systems Design.

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.*

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

All candidates for the degree must complete:

- A. 21 semester hours of required courses in the major, including the four hours of General Education Requirements in Math.*

Required Courses are:

MAT 1213 Calculus I
MAT 1223 Calculus II
MAT 1713 Introduction to Computer Science
MAT 1723 Information Structures
MAT 2213 Calculus III
MAT 3513 Probability and Statistics
MAT 3533 Applied Statistics I

- B. 30 additional semester hours of electives in the *major*, 21 of which must be at the upper-division level and none of which be numbered between 1000 and 1999. These hours may be used to constitute specializations in mathematics, applied mathematics, statistics, computer science, or any combination thereof.
- C. 29 semester hours of *free electives*.

COURSE DESCRIPTIONS

MATHEMATICS, COMPUTER SCIENCE, AND SYSTEMS DESIGN (MAT)

1011 ALGEBRA

(1-0) 1 hour credit.

A course consisting of a series of modules covering aspects of college algebra. Includes: exponents; arithmetic and factorization of polynomials; rational expressions; negative and rational exponents; scientific notation; radicals solving linear and quadratic equations; linear inequalities; absolute values; Cartesian coordinates, distance formula, linear equations; relations, functions, graphing functions.

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.

*The student who is not prepared to begin in MAT 1213 must take from one to three additional pre-calculus hours.

- 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, determinant, inverses of matrices, applications.
- 1043 INTRODUCTORY COMPUTER PROGRAMMING FOR BUSINESS APPLICATIONS**
 (3-0) 3 hours credit. Prerequisite: MAT 1011.
 Introductory FORTRAN programming. Sorting and ranking; plotting; inventory control.
- 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; conditional probabilities and independent events; relative frequency interpretation of probability.
- 1062 STATISTICS**
 (2-0) 2 hours credit. Prerequisite: MAT 1051.
 Relative frequency interpretation of probability and related notions such as distribution functions; random variables; expected values; descriptive statistics; some common distributions: the binomial, Poisson, normal and sampling distributions from the normal; interval estimates; test of hypotheses.
- 1073 INTRODUCTORY COMPUTER PROGRAMMING FOR NUMERICAL APPLICATIONS**
 (3-0) 3 hours credit. Prerequisite: MAT 1011.
 Introductory FORTRAN programming. Sorting and ranking; plotting; numerical taxonomy. Solution of non-linear equations; linear regression. Solution of linear systems.
- 1083 INTRODUCTORY COMPUTER PROGRAMMING FOR NON-NUMERICAL APPLICATIONS**
 (3-0) 3 hours credit. Prerequisite: MAT 1011 or MAT 1122.
 Introductory FORTRAN programming. Sorting and ranking; plotting; cataloging and information storage and retrieval.
- 1092 TRIGONOMETRY**
 (2-0) 2 hours credit. Prerequisite: MAT 1011.
 A basic study of the measurement of angles, the six trigonometric functions and elementary identities.
- 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: Must have a declared major of

- Elementary Education and MAT 1112.
The real number system, complex numbers.
- 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.
- 1223 **CALCULUS II**
(3-0) 3 hours credit. Prerequisite: MAT 1213.
The Riemann integral and the fundamental theorem of calculus. Transcendental functions, polar coordinates, methods of integration and applications of the integral.
- 1713 **INTRODUCTION TO COMPUTER SCIENCE**
(3-0) 3 hours credit.
Introduction to algebraic language programming and to algorithmic processes.
- 1723 **INFORMATION STRUCTURES**
(3-0) 3 hours credit. Prerequisite: MAT 1713.
Introduction to machine language programming and effective methods of representing information in a modern digital computer.
- 2013 **STATISTICAL METHODS IN THE LIFE AND SOCIAL SCIENCES I**
(3-0) 3 hours credit. Prerequisites: MAT 1062.
Small sample inference; comparing several means; method of least squares and linear and non-linear regression; the chi square distribution and categorical data; non-parametric methods. Emphasis on applications and examples in the life and social sciences.
- 2113 **APPLIED MATHEMATICS**
(3-0) 3 hours credit. Prerequisite: MAT 1223.
Introduction to the modern applications of mathematics in the physical, biological and social sciences.
- 2123 **ELEMENTARY DIFFERENTIAL EQUATIONS**
(3-0) 3 hours credit. Prerequisite: MAT 1223.
Basic notions of differential equations: solution of linear equations with constant coefficient; n^{th} order initial value problems; power series solutions of differential equations; introduction to two-point boundary value problems.
- 2213 **CALCULUS III**
(3-0) 3 hours credit. Prerequisite: MAT 1223.
Topics in differential and integral calculus, infinite series and differential equations. Basics of linear algebra
- 2223 **CALCULUS IV**
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Topics in differential and integral calculus, calculus of \mathbb{R}^3 , Green's theorem, Stokes' theorem, partial derivatives and 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.
- 2713 DISCRETE MATHEMATICAL STRUCTURES**
 (3-0) 3 hours credit. Prerequisite: MAT 1723.
 A survey of Boolean algebra, group theory, logic, Turing machines and Markov processes and their applications in computer science.
- 2723 LOGIC DESIGN AND COMPUTER ORGANIZATION**
 (3-0) 3 hours credit. Prerequisite: MAT 2713.
 Switching circuits. Computer arithmetic and design of fixed and floating point arithmetic units. Systems architecture design.
- 3013 STATISTICAL METHODS IN THE LIFE AND SOCIAL SCIENCES II**
 (3-0) 3 hours credit. Prerequisites: MAT 2013 and MAT 1713 or MAT 1073.
 An introduction to multivariate statistical methods: the multinormal 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: Must have a declared major of Elementary Education, or MAT 1123.
 Linear equations, quadratic equations, systems of equations and inequalities.
- 3123 GEOMETRY FOR ELEMENTARY TEACHERS**
 (3-0) 3 hours credit. Prerequisite: Must have a declared major of Elementary Education and MAT 1122.
 The nature of geometry from an intuitive and from a formal point of view, with applications. Topics include: congruence, measurement, parallelism, similarity.
- 3213 FOUNDATIONS OF ANALYSIS**
 (3-0) 3 hours credit. Prerequisite: MAT 2223.
 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.
- 3513 PROBABILITY AND STATISTICS**
(3-0) 3 hours credit. Prerequisite: MAT 2223.
Basic concepts of probability; probability distributions and densities; mathematical expectation; examples of discrete and continuous distributions; random variables.
- 3523 MATHEMATICAL STATISTICS**
(3-0) 3 hours credit. Prerequisite: MAT 3513.
Functions of random variables; distribution theory; central limit theorem; sampling distributions; theory of estimation and hypothesis testing.
- 3533 APPLIED STATISTICS I**
(3-0) 3 hours credit. Prerequisite: MAT 3513.
Methodology of applied statistics; simple and compound tests of hypotheses; confidence intervals and point estimation; tests for randomness and independence; introduction to queuing theory.
- 3613 DIFFERENTIAL EQUATIONS I**
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Introduction to the theory of ordinary differential equations. Existence and uniqueness, linear differential equations, stability.
- 3623 DIFFERENTIAL EQUATIONS II**
(3-0) 3 hours credit. Prerequisite: MAT 3613.
Introduction to theory of partial differential equations. First order equations, second order elliptic, parabolic and hyperbolic equations.
- 3633 NUMERICAL ANALYSIS I**
(3-0) 3 hours credit. Prerequisites: MAT 2213 and MAT 1723.
Solution of linear and non-linear equations, curve-fitting, numerical integration.
- 3643 NUMERICAL ANALYSIS II**
(3-0) 3 hours credit. Prerequisite: MAT 3633.
Numerical solution of ordinary and partial differential equations.
- 3713 ANALYSIS OF ALGORITHMS**
(3-0) 3 hours credit. Prerequisites: MAT 2213 and MAT 2723.
Analysis of the efficiency of algorithms and data structures.
- 3723 PROGRAMMING LANGUAGES**
(3-0) 3 hours credit. Prerequisite: MAT 3713.
The structure of FORTRAN and ALGOL-like languages. Study of their implementation.
- 3733 DATA ACQUISITION**
(3-0) 3 hours credit. Prerequisite: MAT 2723.
Analog to digital and digital to analog conversion. Sampling.
- 3743 REAL-TIME PROCESS CONTROL**
(3-0) 3 hours credit. Prerequisite: MAT 3733.
Real-time programming for process control.

- 3753 **ANALOG COMPUTING**
 (3-0) 3 hours credit. Prerequisite: MAT 2123 or MAT 3613 and PHY 3704.
 Introduction to the principles of analog computers, operational amplifiers, feedback and scaling.
- 3763 **HYBRID COMPUTING**
 (3-0) 3 hours credit. Prerequisite: MAT 3753.
 Basics of hybrid computing.
- 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 may include: The Bernstein Polynomial Theorem, Stone-Weierstrass Theorem and the derivative in \mathbb{R}_p .
- 4223 **REAL ANALYSIS II**
 (3-0) 3 hours credit. Prerequisite: MAT 4413.
 The Riemann-Stieltjes integral and related topics which may include: the bounded convergence theorem, the Riesz representation theorem and the main theorems of integral calculus in \mathbb{R} and \mathbb{R}_p .
- 4233 **MODERN ABSTRACT ALGEBRA I**
 (3-0) 3 hours credit. Prerequisite: MAT 2223.
 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 **MULTIVARIATE STATISTICS**
 (3-0) 3 hours credit. Prerequisites: MAT 3263 and MAT 3533.
 Theory and methodology of multivariate statistics: the multinormal and related sampling distributions; tests of hypothesis; multiple and partial correlation; linear hypothesis; principal components and factor analysis.
- 4523 **APPLIED STATISTICS II**
 (3-0) 3 hours credit. Prerequisite: MAT 3533.
 Simple linear regression, one-way analysis of variance; bivariate normal distribution and correlation; fixed random and mixed model anova; linear and non-linear regression.

- 4533 **NON-PARAMETRIC STATISTICAL METHODS**
 (3-0) 3 hours credit. Prerequisite: MAT 3533.
 A survey of non-parametric methods; order statistics; test 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 3523.
 An introduction to the theory and applications of stochastic processes with emphasis on Markov processes.
- 4613 **OPERATIONS RESEARCH I**
 (3-0) 3 hours credit. Prerequisites: MAT 3513 and MAT 1723.
 Introduction to analytical methods of operations research. Mathematical programming, dynamic programming, game theory and network flow theory.
- 4623 **OPERATIONS RESEARCH II**
 (3-0) 3 hours credit. Prerequisite: MAT 4613.
 Introduction to stochastic models in operations research.
- 4713 **COMPILERS AND ASSEMBLERS**
 (3-0) 3 hours credit. Prerequisite: MAT 3723.
 Design, construction and implementation of assemblers and compilers.
- 4723 **COMPUTERS AND PROGRAMMING SYSTEMS**
 (3-0) 3 hours credit. Prerequisite: MAT 4713.
 Loaders, job sequencers and supervisory systems.
- 4733 **SEQUENTIAL MACHINES**
 (3-0) 3 hours credit. Prerequisite: MAT 2713.
 Theory of finite-state machines. Minimization and decomposition problems with applications to digital computers.
- 4743 **FORMAL LANGUAGES AND AUTOMATA**
 (3-0) 3 hours credit. Prerequisite: MAT 4733.
 Theory of formal languages and applications to programming languages.