The Division offers a Bachelor of Science Degree in Biology, as well as joint degree programs with The University of Texas Health Science Center at San Antonio, leading to the Bachelor of Science Degree in Medical Technology, Occupational Therapy, and Physical Therapy. Degrees in these three Allied Health programs are awarded jointly by both institutions. Also available are pre-professional courses which offer the students the opportunity to prepare for admission to medical, dental, nursing, and other professional schools.\(^{21}\)

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

The B.S. Degree in Medical Technology is a joint degree between The University of Texas at San Antonio and The University of Texas Health Science Center. The pre-clinical curriculum includes general education requirements and basic science lecture and laboratory courses. The Joint Degree Program is a four year program of study offered by UTSA and The University of Texas Health Science Center and the degree is awarded jointly by both institutions. Medical technology concepts are introduced throughout the curriculum, ending in a senior year clinical rotation at the Health Science Center. Upon completion of all requirements the student is eligible to take the medical technology national board examinations of the American Society of Clinical Pathologists.

The Bachelor of Science Degree in Occupational Therapy offers the opportunity for the student to gain a strong background in the life sciences, behavioral sciences, humanities, and special skill areas. Specific application of occupational therapy skills in laboratory and clinical settings occurs in the last two years of a student’s program and includes a minimum of six months approved field work experience. Upon successful completion of this joint degree program, the student must take one additional Fieldwork Level II placement course, available as OCCT 40875 at the University of Texas Science Center, to be eligible to take the national examination for registration with the American Occupational Therapy Association. An additional fieldwork placement course (OCCT 40876) is optional.

The B.S. Degree in Physical Therapy offers the opportunity for students to emphasize the basic sciences necessary to understand human response during illness and disability, as well as during the rehabilitation process. Clinical observation and field work experiences are integrated into the academic preparation during the professional phase of the program. This program is fully accredited by the American Physical Therapy Association and students are eligible to take the Physical Therapy licensure examination following successful completion of this joint degree program.

\(^{21}\)Specific premedical, predental, and prenursing programs are not offered at UT San Antonio. Admission requirements for these professional schools are outlined in the Appendix of this catalog. Additional information can be obtained from the Office of the Division of Allied Health and Life Sciences and through the Chairman of the Health Related Professions Advisory Committee of The University of Texas at San Antonio.
BACHELOR OF SCIENCE DEGREE IN BIOLOGY

The minimum number of semester hours required for the Bachelor of Science Degree in Biology, including the 42 hours of General Education Requirements, is 126. All candidates for the degree must complete:

A. 48 semester hours in the major, 28 of which must be at the upper-division level.
   1. 28 semester hours in the Biology Core Curriculum are required:
      - BIO 1103, 1112 Principles of Biology and Laboratory
      - BIO 1213, 1222 Principles of Ecology and Laboratory
      - BIO 2313, 2322 Genetics and Laboratory
      - BIO 3413, 3422 General Physiology and Laboratory
      - BIO 3513, 3522 Biochemistry and Laboratory
      - BIO 4963 Seminar in Biology
   2. 20 additional semester hours of Biology electives are required, 15 of which must be at the upper-division level and must include a minimum of 3 courses with laboratories.

B. 24 semester hours minimum of support work.
   1. 13 semester hours are required in Chemistry:
      - CHE 1103 Introductory Chemistry
      - CHE 2003 Chemical Principles
      - CHE 2012 Inorganic Qualitative and Quantitative Analysis
      - CHE 2203 Organic Chemistry I
      - CHE 2242 Organic Chemistry I Laboratory
   2. 3 semester hours minimum in addition to the 3 semester hours required under the General Education Requirements are required in Mathematics:
      - MAT 1214 Calculus I
      or
      - STA 1993 Statistical Methods for the Life and Social Sciences
   3. 8 semester hours are required in Physics:
      - PHY 1803, 1811 Physics for Life Sciences I and Laboratory
      - PHY 1823, 1831 Physics for Life Sciences II and Laboratory

C. 12 semester hours of electives, 6 of which must be at the upper-division level.

BACHELOR OF SCIENCE DEGREE IN MEDICAL TECHNOLOGY

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

UTSA/UTHSC JOINT DEGREE MEDICAL TECHNOLOGY PROGRAM

In the Joint Degree Program, medical technology courses are offered throughout the course of study, culminating in a concentrated clinical hospital experience at the Health Science Center. Participation in medical technology courses does not guarantee acceptance into the Medical Technology Program. The student must complete a

**Thirty-nine of the total semester hours required for the degree must be at the upper-division level.**
separate application form which may be obtained in the Medical Technology Office, The University of Texas Health Science Center at San Antonio. This application should be submitted at the completion of the student’s sophomore year between June 15 and April 15. Admission to the Joint Degree Program and successful continuation in the program, provide the student with a clinical position at the Health Science Center for continuation of medical technology training.

Upon successful completion of this joint degree program the student is eligible to take the national examination for registration with the Board of Registry of the American Society of Clinical Pathologists. All students are encouraged to be counseled by either the Medical Technology Program Director or a member of the Medical Technology faculty to ensure enrollment in appropriate course work.

UTSA/UTHSC JOINT DEGREE MEDICAL TECHNOLOGY PROGRAM

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 142.

All candidates for the degree must complete:

A. 79 semester hours in the major.

1. 22 semester hours are required in the biological sciences:
   
   BIO 1103, 1112 Principles of Biology and Laboratory
   BIO 2313 Genetics
   BIO 3513, 3522 Biochemistry and Laboratory
   BIO 3713, 3722 Microbiology and Laboratory
   BIO 4743, 4751 Immunology and Laboratory

2. 11 semester hours are required in Allied Health Sciences:
   
   AHS 1883 Introduction to Medical Technology
   AHS 3463 Human Physiology
   AHS 4783, 4792 Pathogenic Microorganisms and Laboratory

3. *46 semester hours are required in Medical Technology:

   a. These courses are taken prior to the hospital clinical rotation:
      
      *MEDT 20351, 20252 Hematology and Laboratory
      *MEDT 20301, 20202 Parasitology and Urinalysis and Laboratory
      *MEDT 30361, 30262 Immunohematology and Serology and Laboratory
      *MEDT 30381, 30282 Clinical Chemistry and Laboratory

   b. These courses are the hospital clinical rotation:
      
      *MEDT 40333 Advanced Clinical Microbiology
      *MEDT 40383 Advanced Clinical Chemistry
      *MEDT 40353 Advanced Clinical Hematology
      *MEDT 40365 Advanced Clinical Immunohematology and Serology
      *MEDT 40671 Clinical Field Work Experience I
      *MEDT 40672 Clinical Field Work Experience II
      *MEDT 40192 Education Techniques for the Medical Technologist
      *MEDT 40193 Management Techniques for Medical Technologists

B. 21 semester hours of support work.

*Courses to be taken at The University of Texas Health Science Center at San Antonio.
1. 10 semester hours are required in Chemistry:
   - CHE 2003 Chemical Principles
   - CHE 2012 Inorganic Qualitative and Quantitative Analysis
   - CHE 2203 Organic Chemistry I
   - CHE 2242 Organic Chemistry I Laboratory

2. 8 semester hours are required in Physics:
   - PHY 1803, 1811 Physics for Life Sciences I and Laboratory
   - PHY 1823, 1831 Physics for Life Sciences II and Laboratory

3. 3 semester hours (in addition to the 3 semester hours required under the General Education Requirements) are required in Mathematics:
   - STA 1053 Basic Statistics

**BACHELOR OF SCIENCE DEGREE IN OCCUPATIONAL THERAPY**

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

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

All students are encouraged to be counseled by either the Occupational Therapy Program Director or a member of the Occupational Therapy faculty to ensure enrollment in appropriate course work.

Each student must make application for admission to the professional phase of the Occupational Therapy Program by February 15th of the year they wish to be admitted. The application process can be initiated by writing to: Admissions Committee, Occupational Therapy Program, The University of Texas Health Science Center at San Antonio, San Antonio, Texas, 78284. Students who apply must be at least in the first semester of their Sophomore year. It is the responsibility of the applicant to submit official transcripts to the UTSA Office of Admissions prior to February 15. It is also the applicant's responsibility to have three letters of reference submitted to the Occupational Therapy Admissions Committee with their application form.

All students are expected to have an interview with two or more designated interviewers from the Occupational Therapy Faculty after the close of application on February 15th and prior to student selection April 1st.

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

**BACHELOR OF SCIENCE DEGREE IN OCCUPATIONAL THERAPY**

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 138.
All candidates for the degree must complete:

A. 86 semester hours in the major, 80 of which must be at the upper-division level.

1. 4 semester hours are required in the biological sciences:
   - BIO 2123, 2131 Comparative Anatomy of Vertebrates and Laboratory
   - or
   - AHS 2083, 2091 Human Biology: Anatomy and Laboratory

2. 6 semester hours are required in Allied Health Sciences:
   - **AHS 1871 Allied Health Sciences
   - AHS 1891 Survey of Physical Medicine and Rehabilitation
   - AHS 3463, 3471 Human Physiology and Laboratory

3. 76 semester hours are required at the University of Texas Health Science Center at San Antonio:
   - *OCCT 30200 Principles of Practice
   - *OCCT 30321 Occupational Therapy Media I
   - *OCCT 30322 Occupational Therapy Media II
   - *OCCT 30475 Dynamics of Motion
   - *OCCT 30331 Occupational Therapy Theory I
   - *OCCT 30391 Occupational Therapy Skills Laboratory I
   - *OCCT 40392 Occupational Therapy Skills Laboratory II
   - *OCCT 40393 Occupational Therapy Skills Laboratory III
   - *OCCT 40223 Occupational Therapy Media III
   - *OCCT 40332 Occupational Therapy Theory II
   - *OCCT 40150 Seminar in Rehabilitation
   - *OCCT 40333 Occupational Therapy Theory III
   - *OCCT 40382 Allied Health Management and Consultation
   - *OCCT 40394 Special Project
   - *PATH 30311 Introductory Pathology
   - *ANAT 30816 Human Anatomy
   - *INDT 30471 Human Neurosciences
   - *MEDI 30311 Clinical Medicine I
   - *MEDI 40212 Clinical Medicine II
   - *MEDI 40313 Clinical Medicine III
   - *OCCT 30271 Fieldwork Level I (Physical Dysfunction)
   - *OCCT 30272 Fieldwork Level I (Psychosocial Dysfunction)
   - *OCCT 30273 Fieldwork Level I (Pediatrics)
   - *OCCT 40874 Fieldwork Level IIA

B. 10 semester hours of support work.

1. 4 semester hours are required in Chemistry:
   - CHE 1003, 1111 General Chemistry for Allied Health Sciences and Laboratory
   - or
   - CHE 1103, 1122 Introductory Chemistry and Laboratory Workshop

2. 6 semester hours are required in Psychology:
   - PSY 2513 Abnormal Psychology
   - PSY 2523 Personality

*Courses to be taken at The University of Texas Health Science Center at San Antonio.
**UTSA Students only.
BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY

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

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

Each student must make application for admission to the professional phase of the Physical Therapy Program by December 15th prior to the summer in which they wish to be admitted. This application process can be initiated by writing to: Admission Committee, Physical Therapy Program, The University of Texas Health Science Center at San Antonio, San Antonio, Texas 78284. It is the responsibility of the applicant to submit official transcripts to the UTSA Office of Admissions and Registrar prior to December 15. It is also the applicant's responsibility to have three letters of reference submitted to the Physical Therapy Committee with their application form.

All qualified students are expected to have an interview with Physical Therapy Faculty after the close of application on December 15th and prior to announcement of student selections on April 1st. Each student is expected to complete all General Education Requirements for graduation from UTSA, as well as program prerequisites for Physical Therapy, by June of the year of admission to the professional phase of the Physical Therapy Program.

BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 150.

All candidates for the degree must complete:

A. 95 semester hours in the major, 80 of which must be at the upper-division level:
   1. 12 semester hours are required in the biological sciences:
      BIO 1103, 1112 Principles of Biology and Laboratory
      BIO 2123, 2131 Comparative Anatomy of Vertebrates and Laboratory
      or
      AHS 2083, 2091 Human Biology: Anatomy and Laboratory
      BIO 3413 General Physiology
   2. 2 semester hours are required in Allied Health Sciences:
      **AHS 1871 Allied Health Sciences
      **AHS 1891 Survey of Physical Medicine and Rehabilitation
   3. *81 semester hours are required at The University of Texas Health Science Center at San Antonio:
      *PATH 30311 Introductory Pathology
      *ANAT 30816 Human Anatomy
      *PHYL 30612 Mammalian Physiology

*Courses to be taken at The University of Texas Health Science Center at San Antonio.
**UTSA Students only
BACHELOR OF SCIENCE DEGREE IN PHYSICAL THERAPY — BIOLOGY

*MED | 30311 | Clinical Medicine I
*MED | 40313 | Clinical Medicine II
*INDT | 30471 | Human Neurosciences
*PHYT | 30311 | Fundamentals of Patient Care Management
*PHYT | 30120 | Physical Therapy History and Philosophy
*PHYT | 30330 | Physical Therapy Procedures
*PHYT | 30471 | Clinical Fieldwork I
*PHYT | 30475 | Dynamics of Motion
*PHYT | 40310 | Therapeutic Concepts and Procedures in Physical Therapy
*PHYT | 40440 | Normal and Abnormal Human Growth and Development
*PHYT | 40311 | Advanced Therapeutic Concepts and Procedures in Physical Therapy
*PHYT | 40321 | Therapeutic Exercise I
*PHYT | 40322 | Therapeutic Exercise II
*PHYT | 40150 | Seminar in Rehabilitation
*PHYT | 40151 | Senior Seminar
*PHYT | 30101 | Directed Clinical Experience I
*PHYT | 30102 | Clinical Observation I
*PHYT | 30103 | Clinical Observation II
*PHYT | 40104 | Simulated Clinic
*PHYT | 40105 | Directed Clinical Experience II
*PHYT | 41072 | Clinical Fieldwork II
*PHYT | 40382 | Allied Health Management and Consultation
*PHYT | 40394 | Special Projects

B. 13 semester hours of support work.

1. 5 semester hours are required in Chemistry:
   CHE 2003 | Chemical Principles
   CHE 2012 | Inorganic Qualitative and Quantitative Analysis

2. 8 semester hours are required in Physics:
   PHY 1803, 1811 | Physics for Life Sciences I and Laboratory
   PHY 1823, 1831 | Physics for Life Sciences II and Laboratory

COURSE DESCRIPTIONS

BIOLOGY (BIO)

1013 Introduction to Life Sciences
(3-0) 3 hours credit. Concurrent enrollment in BIO 1021 recommended. May not be applied to a B.S. in Biology.
An introduction to the life sciences emphasizing general principles, diversity of life forms, reproduction and interrelationships between living things. Credit cannot be earned for both BIO 1013 and BIO 1103.

1021 Introduction to Life Sciences Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 1013. May not be applied to a B.S. in Biology.
Laboratory exercises, films and demonstrations in biology. Credit cannot be earned for both BIO 1021 and BIO 1112.

1103 Principles of Biology
(3-0) 3 hours credit. Concurrent enrollment: BIO 1112.

*Courses to be taken at The University of Texas Health Science Center at San Antonio.
An introduction to living organisms emphasizing fundamentals of organization, reproduction, growth and interrelationships between various forms of life, including a brief survey of the plant and animal groups. Required for students majoring in Biology. Credit cannot be earned for both BIO 1013 and BIO 1103.

1112 Principles of Biology Laboratory
(0-6) 2 hours credit. Concurrent enrollment: BIO 1103.

1213 Principles of Ecology
(3-0) 3 hours credit. Prerequisites: BIO 1103 and BIO 1112. Concurrent enrollment: BIO 1222. The opportunity to study the interaction of organisms with their environment, ecological principles, adaptations of organisms, environmental pollution and principles of conservation.

1222 Principles of Ecology Laboratory
(0-6) 2 hours credit. Concurrent enrollment: BIO 1213. A field-oriented course emphasizing modern ecological techniques, including examinations of plant and animal populations, and measurement of selected chemical and physical parameters.

2003 Human Sex and Reproduction
(3-0) 3 hours credit. Prerequisite: BIO 1013 or 1103 or consent of instructor. May not be applied to a major in Biology. Human reproductive anatomy and physiology, fertility control, reproductive disease, and parameters influencing fertility patterns.

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

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

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

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

2313 Genetics
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 1103, 2003, and MAT 1063 or equivalent. Concurrent enrollment: BIO 2322. Principles governing transmission of hereditary factors in plants and animals with emphasis on molecular, biochemical and population genetics.

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

3003 Introduction to Oceanography
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112, or BIO 1013 and 1021 and CHE 1103, or consent of instructor. General oceanography with emphasis on biological aspects and living marine resources.

3012 Introductory Pathology
(2-0) 2 hours credit. Prerequisites: BIO 1103, 1112 or BIO 1013 and 1021 or AHS 2103. Concepts of disease and diagnosis of pathological conditions.

3023 Drugs and Society
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112, or BIO 1013 and 1021 and CHE 1103, or consent of instructor. An examination of drugs and their biosocial effects.

3083 Biosocial Genetics
(3-0) 3 hours credit. Prerequisite: Consent of instructor. A study of human heredity and social issues with emphasis on inherited diseases, genetic problems and evolutionary change in relation to culture, diversity and mating systems.
3143 **Comparative Vertebrate Embryology**  
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422. Concurrent enrollment: BIO 3151. 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. Concurrent enrollment: BIO 3143.

3162 **Histology and Cytology**  
(2-0) 2 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 3172. The cytological and histological aspects of cellular organization.

3172 **Histological and Cytological Laboratory**  
(0-6) 2 hours credit. Concurrent enrollment: BIO 3162.

3203 **Plant Ecology**  
(3-0) 3 hours credit. Prerequisite: BIO 1213, 1222, or consent of instructor. Concurrent enrollment: BIO 3211. A study of the major biomes of North America and Texas, including the chemical, physical and biological factors that influence the development of these biomes.

3211 **Plant Ecology Laboratory**  
(0-3) 1 hour credit. Concurrent enrollment: BIO 3203. A course providing the opportunity for field-oriented study to examine qualitative and quantitative methods to evaluate plant communities.

3213 **Animal Ecology**  
(3-0) 3 hours credit. Prerequisites: BIO 1213 and 1222. Concurrent enrollment: BIO 3221. 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. Concurrent enrollment: BIO 3213.

3243 **Field Biology and Ecology**  
(3-0) 3 hours credit. Prerequisites: BIO 1013 and 1021, or BIO 1103, 1112, or consent of instructor. Concurrent enrollment: BIO 3251. A study of the natural history of plants and animals in their native environment. Techniques for the identification of birds, mammals, reptiles, amphibians, insects, and the dominant flowering plants will be discussed.

3251 **Field Biology and Ecology Laboratory**  
(0-3) 1 hour credit. Concurrent enrollment: BIO 3243. A field-oriented course offering the opportunity for practical experience observing, collecting and identifying Texas plants and animals.

3263 **Ornithology**  
(2-3) 3 hours credit. Prerequisites: BIO 1213 and 1222. A detailed examination of the class Aves, stressing the taxonomy, anatomy, physiology, ecology and behavior of birds. Lecture, laboratory and field work will be included as part of the course.

3273 **Spring Flowers**  
(2-3) 3 hours credit. A study of the wild flowers of Texas, emphasizing identification of the more common wild flowers, as well as family characteristics, flower anatomy, and plant morphology. Plant collecting techniques and wild flower photography will be included. Lecture, laboratory and field work will be included as part of the course.

3323 **Evolution**  
(3-0) 3 hours credit. Prerequisite: BIO 2313. A discussion of theories and possibly mechanisms for evolutionary changes at various levels of organization.

3343 **Plant Sciences**  
(3-0) 3 hours credit. Prerequisites: BIO 1103 and 1112. Concurrent enrollment: BIO 3351. A course offering the opportunity to study the life histories and phylogenetic relationships of vascular and non-vascular plants.
3351 Plant Sciences Laboratory  
(0-3) 1 hour credit. Concurrent enrollment: BIO 3343.

3413 General Physiology  
(3-0) 3 hours credit. Prerequisites: BIO 1103, CHE 2003 and PHY 1823; recommended: MAT 1093. Concurrent enrollment: BIO 3422. 
Fundamental properties and processes in living systems.

3422 General Physiology Laboratory  
(0-6) 2 hours credit. Concurrent enrollment: BIO 3413.

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

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

3533 Radiation Biology  
(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522. Concurrent enrollment: BIO 3541. 
The course offers the opportunity to study the interactions of ionizing, ultraviolet, and visible radiations with matter; biological effects; and cellular repair of radiation damage.

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

3713 Microbiology  
(3-0) 3 hours credit. Prerequisites: BIO 2313 and CHE 2203. Concurrent enrollment: BIO 3722. 
A comprehensive study of microorganisms including their composition, morphology, growth, metabolism, classification, ecology and significance in disease.

3722 Microbiology Laboratory  
(0-6) 2 hours credit. Concurrent enrollment: BIO 3713.

3733 Industrial Microbiology  
(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722. Concurrent enrollment: BIO 3741. 
A study of fermentations of industrial importance, food processing, and quality control.

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

3813 Cellular Biology  
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3513. Concurrent enrollment: BIO 3821. 
A study of cellular function with relation to structure from the microscopic to molecular level.

3821 Cellular Biology Laboratory  
(0-3) 1 hour credit. Concurrent enrollment: BIO 3813.

4003 Principles of Marine Biology  
(3-0) 3 hours credit. Prerequisite: BIO 1213. Concurrent enrollment: BIO 4011. 
A study of the fauna and flora of marine ecosystems with special emphasis on the Northwestern Gulf Coast.

4011 Principles of Marine Biology Laboratory  
(0-3) 1 hour credit. Concurrent enrollment: BIO 4003. 
The course offers the opportunity for shallow and deep water collection, identification and observation of fauna and flora of marine ecosystems. Laboratory and field work will be included.

4013 Electron Microscopy  
(1-6) 3 hours credit. Prerequisite: junior or senior standing with 20 hours in Biology. 
A course offering the opportunity to study the principles of the electron microscope and biological sample preparation. Practical laboratory experience in tissue handling, fixation, embedding, sectioning, staining and photographic techniques will be included.
4043 Desert Ecology
(2-3) 3 hours credit. Prerequisites: BIO 1213 and 1222.
A study of the deserts of the world with an emphasis on U. S. Deserts. Adaptations of plants and animals and their responses to desert conditions will be included, as well as examinations of desert climatic patterns, geology, and natural history. Lecture, laboratory and field work will be included.

4073 Law, Ethics and the Life Sciences
(3-0) 3 hours credit. Prerequisites: BIO 1013 or BIO 1103 and 1112, or consent of instructor.
An examination of the ethical, philosophical and social implications of studies in those areas of the life sciences which affect public policy or action, e.g., incentives to slow population growth; psychology of consciousness and definitions of life and death.

4333 Population Genetics
(3-0) 3 hours credit. Prerequisites: BIO 2313 and 2322.
A quantitative approach to the study of genetics systems in populations, including mutations, selection, polymorphism and mating systems.

4343 Molecular Genetics
(3-0) 3 hours credit. Prerequisites: BIO 2313, 2322, 3513 and 3522.
Molecular approach to structure, replication, mutation and phenotypic expression of genetic material.

4353 Comparative Physiology
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422. Concurrent enrollment: BIO 4361.
A phylogenetic study of physiologic adaptation in animals.

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

4413 Mammalian Physiology
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422 or consent of the instructor. Concurrent enrollment: BIO 4421.
A study of the basic processes and functions of organs and organ systems in the mammalian body, with consideration of human and other mammalian physiological functions.

4421 Mammalian Physiology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 4413.
A laboratory course emphasizing principles presented in BIO 4413.

4433 Neurobiology
(3-0) 3 hours credit. Prerequisites: BIO 3413 and 3422.
Anatomy and physiology of nervous systems, the mechanisms of neuronal functions.

4443 Endocrinology
(3-0) 3 hours credit. Prerequisites: BIO 3413, 3422, 3513 and 3522.
A consideration of the physiological effects of hormones on the organism in health and disease, together with a study of the gross and microscopic morphology of the glands of internal secretion.

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

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

4611 Plant Physiology Laboratory
(0-3) 1 hour credit. Concurrent enrollment: BIO 4603.
A course providing qualitative and quantitative experiments in the study of plant physiology.
4723 Virology  
(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522, 3713, 3722. Concurrent enrollment: BIO 4731. 
A study of the diversity of viruses and biochemical mechanisms for their replication.

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

4743 Immunology  
(3-0) 3 hours credit. Prerequisites: BIO 3513 and 3522, 3713, 3722. Concurrent enrollment: BIO 4751. 
A study of the properties of antigens and antibodies, current concepts of humoral and cell-mediated immunity and the cells involved.

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

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

4771 Parasitology Laboratory  
(0-3) 1 hour credit. Concurrent enrollment: BIO 4763.

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

4951·3 Special Studies in Biology  
1-3 hours credit. Prerequisite: Consent of instructor. 
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours within any one discipline will apply to a bachelor's degree.

4963 Seminar in Biology  
(3-0) 3 hours credit. Prerequisite: junior or senior standing with a minimum of 20 hours in biological sciences. 
An undergraduate seminar limited to biology majors, which provides an opportunity to survey selected biological references with emphasis on utilization of journals, scientific writing, and presentation of scientific data. Presentation and discussion of current publications in biological technology will be included. May not be repeated for credit applied toward a degree.

COURSE DESCRIPTIONS
ALLIED HEALTH SCIENCES
(AHS)

1053 Introductory Microbiology  
(3-0) 3 hours credit. Prerequisite: BIO 1013 with BIO 1021 strongly recommended, or BIO 1103 and 1112, or consent of instructor. 
May not be applied to a B.S. in Biology. Concurrent enrollment: AHS 1061. 
A general study of microorganisms, their characteristics, isolation, growth, and importance in nature, industry, public health and human disease.

1061 Introductory Microbiology Laboratory  
(0-3) 1 hour credit. 
May not be applied to a B.S. in Biology. Concurrent enrollment: AHS 1053.
1871 Allied Health Sciences
(1-0) 1 hour credit.
Nature of the various allied health science programs and their interrelation. On-site hospital visits to the various programs. This course is taught on a credit/no credit basis only. Students completing this course will receive a grade of CR or NC.

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

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

2043 Nutrition
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, or AHS 2103.
An examination of human nutritional needs from infancy to adulthood.

2083 Human Biology: Anatomy
(3-0) 3 hours credit. Prerequisite: BIO 1013 with BIO 1021 strongly recommended, or BIO 1103 and 1112, or consent of instructor. Concurrent enrollment: AHS 2091. May not be applied to B.S. in Biology.
The structure of human muscular, skeletal, nervous and organ systems.

2091 Human Biology: Anatomy Laboratory
(0-3) 1 hour credit.
Concurrent enrollment: AHS 2083. May not be applied to a B.S. in Biology.

2103 Human Biology: Physiology
(3-0) 3 hours credit. Prerequisite: BIO 1013 with BIO 1021 strongly recommended, or BIO 1103 and 1112, or consent of instructor. Concurrent enrollment: AHS 2111. May not be applied to a B.S. in Biology.
Physiological processes in human systems.

2111 Human Biology: Physiology Laboratory
(0-3) 1 hour credit.
Concurrent enrollment: AHS 2103.

3113 Kinesiology
(3-0) 3 hours credit. Prerequisite: AHS 2083 or 2103 or consent of instructor. Primarily designed for students majoring in physical education.
A study of the principles of human motion.

3463 Human Physiology
(3-0) 3 hours credit. Prerequisites: BIO 1103, 1112, CHE 2103 or 2203 or consent of instructor.
Physiological processes in human systems.

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

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

4783 Pathogenic Microorganisms
(3-0) 3 hours credit. Prerequisites: BIO 3713 and 3722. Concurrent enrollment: AHS 4792.
A consideration of medically important microorganisms and their interaction with animal and human hosts.

4792 Pathogenic Microorganisms Laboratory
(0-6) 2 hours credit.
Concurrent enrollment: AHS 4783.
4911-3 Independent Study
1-3 hours credit. Prerequisites: Permission in writing (form available).
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.
DIVISION OF EARTH AND PHYSICAL SCIENCES

The degree programs offered by this Division reflect its policy of offering the opportunity for a comprehensive education of the highest quality, individualized to the needs and interests of the student. Completion of a core curriculum allows the student to apply for entry into one of several highly specialized areas in Applied Science or Chemistry. A student who has majored in any of these degree programs is eligible to apply for positions in industry and government as well as apply for entry into professional and graduate schools.

BACHELOR OF SCIENCE DEGREE IN APPLIED SCIENCE

The Bachelor of Science in Applied Science has two major goals: (1) to provide the student with the opportunity to prepare for employment in one of the option areas (Applied Geology, Applied Physics, Environmental Science, Polymer Science), and (2) to offer the student the opportunity to gain the background necessary for graduate study in a variety of science and engineering specialty areas.

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is dependent upon the option elected: Applied Geology, 134 semester hours; Applied Physics, 134 semester hours; Environmental Science, 138 semester hours; and Polymer Science, 131 semester hours. All candidates for the degree must complete the following core of 28 semester hours (minimum):

1. 25 semester hours in science and mathematics
   - CHE 1103 Introductory Chemistry
   - CHE 2003 Chemical Principles
   - CHE 2012 Inorganic Qualitative and Quantitative Analysis
   - MAT 1214 Calculus I
   - MAT 1223 Calculus II
   - PHY 1904 Technical Physics I
   - PHY 1911 Technical Physics I Laboratory
   - PHY 1924 Technical Physics II
   - PHY 1931 Technical Physics II Laboratory

2. Three (3) semester hours (minimum) in computer science.
   - CS 1073 Introductory Computer Programming for Scientific Applications, or
   - CS 1713 Introduction to Computer Science and
   - CS 1711 Introduction to Computer Science Laboratory

In addition, students must complete one of the following Applied Science options.

---

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

Students seeking teacher certification should consult the Undergraduate certification Programs in Education brochure for information.
Applied Geology

A. 58 semester hours in Applied Geology, 37 of which must be at the upper-division level.

1. 46 semester hours of required courses are:
   - GEO 1003 Introduction to Geology
   - GEO 1011 Introduction to Geology Laboratory
   - GEO 1023 Earth History
   - GEO 1031 Earth History Laboratory
   - GEO 2003 Mineralogy
   - GEO 2011 Mineralogy Laboratory
   - GEO 2023 Optical Mineralogy
   - GEO 2031 Optical Mineralogy Laboratory
   - GEO 2063 Paleontology
   - GEO 2071 Paleontology Laboratory
   - GEO 3043 Petrology
   - GEO 3052 Petrology Laboratory
   - GEO 3083 Stratigraphy
   - GEO 3103 Structural Geology
   - GEO 3111 Structural Geology Laboratory
   - GEO 3123 Sedimentary Geology
   - GEO 3131 Sedimentary Geology Laboratory
   - GEO 3943 Field Methods in Geology
   - GEO 4946 Field Geology

2. 12 additional semester hours of approved elective courses in Applied Geology and Applied Science at the upper-division level are required from the following:
   - AS 4603 Fundamentals of Hydraulic Engineering
   - AS 4911-3 Independent Study
   - AS 4923 Special Project
   - AS 4931-3 Practicum in Applied Science
   - AS 4953 Special Studies in Applied Science
   - GEO 3143 Economic Geology I
   - GEO 3151 Economic Geology Laboratory
   - GEO 3163 Oceanography
   - GEO 3182 Geology of Energy Resources
   - GEO 3191 Geology of Energy Resources — Laboratory
   - GEO 3951-3 Special Interest Topics
   - GEO 4023 Engineering Geology
   - GEO 4063 Principles of Environmental Geology
   - GEO 4113 Geomorphology
   - GEO 4121 Geomorphology Laboratory
   - GEO 4623 Groundwater Hydrology

B. 6 semester hours of support work at the upper-division level with the consent of the advisor.

Applied Physics

A. 58 semester hours in the option.

1. 40 semester hours of required courses are:
   - AS 4923 Special Project
   - PHY 2002 Workshop in Applied Physics
   - PHY 2403 Electronics
230 ENVIRONMENTAL SCIENCE

PHY 2412 Electronics Laboratory
PHY 3103 Modern Physics I
PHY 3203 Dynamics
PHY 3283 Thermal Physics or CHE 3203 Physical Chemistry I
PHY 3313 Materials Physics
PHY 3321 Materials Physics Laboratory
PHY 3423 Electricity and Magnetism I
PHY 3443 Optics
PHY 3452 Optics Laboratory
PHY 4203 Advanced Dynamics
PHY 4263 Introduction to Quantum Mechanics
PHY 4403 Electricity and Magnetism II

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

B. 6 semester hours of required support work in Mathematics to include:
MAT 2213 Calculus III
and 3 additional semester hours chosen from the following:
MAT 2233 Matrix Algebra
MAT 3223 Complex Variables
MAT 3243 Calculus for Applications
MAT 3613 Differential Equations I
MAT 3633 Numerical Analysis I

Environmental Science

A. 48 semester hours in the option. Required courses are:
AS 2203 Statics
AS 3503 Alternative Energy Sources
AS 3663 Fluid Mechanics
AS 3673 Municipal and Rural Sanitation
AS 4603 Fundamentals of Hydraulic Engineering
AS 4633 Water and Wastewater Treatment
AS 4643 Air Pollution and Industrial Hygiene
AS 4933 Practicum in Applied Science
BIO 1103 Principles of Biology
BIO 1112 Principles of Biology Laboratory
BIO 1213 Principles of Ecology
ENV 3023 Man and His Natural Resources
ENV 4603 Environmental Quality Analysis
GEO 1003 Introduction to Geology
GEO 1011 Introduction to Geology Laboratory
GEO 4063 Principles of Environmental Geology
GEO 4623 Groundwater Hydrology

B. 11 semester hours of support work. Required courses are:
AHS 1053 Introductory Microbiology
AHS 1061 Introductory Microbiology Laboratory
CHE 2103 Elementary Organic and Biochemistry
CHE 2111 Organic and Biochemistry Laboratory
CHE 3103 Analytical Chemistry

*With the consent of the student's Advisor, up to 9 hours may be in upper division Mathematics, Computer Science, Systems Design, Chemistry, or Biology courses.*
C. 6 semester hours of approved elective courses at the upper-division level.
D. 3 semester hours of electives.

Polymer Science
A. 34 semester hours in the option, all of which must be at the upper-division level.
1. 20 semester hours of required courses are:
   AS 4923 Special Project
   AS 4933 Practicum in Applied Science
   PS 3603 Polymer Science I
   PS 3612 Polymer Science I Laboratory
   PS 3623 Polymer Science II
   PS 3632 Polymer Science II Laboratory
   PS 4653 Polymer Technology
   PS 4661 Polymer Technology Laboratory
2. 14 additional semester hours of approved elective courses in Applied Science and Polymer Science at the upper-division level to be chosen from the following:
   AS 2203 Statics
   AS 3213 Mechanics of Solids
   AS 3241 Materials Laboratory
   PS 3643 Natural and Synthetic Organic Polymers
   PS 3651 Natural and Synthetic Organic Polymers Laboratory
   PS 4623 Coatings Technology
   PS 4643 Polymer Processes
   PS 4703 Organic Chemistry of Coatings
   PS 4743 Industrial and Commercial Applications of Polymers
B. 24 semester hours of support work.
1. 18 semester hours of required courses are:
   CHE 2203 Organic Chemistry I
   CHE 2242 Organic Chemistry I Laboratory
   CHE 3003 Organic Chemistry II
   CHE 3022 Organic Chemistry II Laboratory
   CHE 3203 Physical Chemistry I
   CHE 3212 Physical Chemistry I Laboratory
   CHE 3223 Physical Chemistry II
2. 6 additional semester hours of upper-division coursework are required in an area of applied science, biology and/or chemistry, with the consent of the advisor.
C. 3 semester hours of electives.

COURSE DESCRIPTIONS
APPLIED GEOLOGY
(GEO)

1003 Introduction to Geology
(3-0) 3 hours credit. Concurrent enrollment in GEO 1011 recommended.
The Earth as a dynamic planet; relation of Earth's present day processes to its materials, structure and internal constitution. Nature of minerals and rocks, the hydrosphere, tectonics, and surface features of Earth.
1011 **Introduction to Geology Laboratory**
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: GEO 1003.
Relation of Earth's present day processes to its materials, structure and internal constitution.
Field trips and laboratory study of minerals, rocks, maps and air and satellite photos.

1023 **Earth History**
(3-0) 3 hours credit. Concurrent enrollment in GEO 1031 recommended.
Formation and evolution of the Earth, its life forms, and the major features of its surface.

1031 **Earth History Laboratory**
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: GEO 1023.
Laboratory study of fossils and rock sequences; interpretation of Earth history.

2003 **Mineralogy**
(3-0) 3 hours credit. Prerequisites: GEO 1003 and 1011. Concurrent enrollment: GEO 2011.
Crystallography, chemistry, physical properties and origin of minerals.

2011 **Mineralogy Laboratory**
(0-2) 1 hour credit. Concurrent enrollment: GEO 2003.
Laboratory study of crystal models, crystals and minerals.

2023 **Optical Mineralogy**
(3-0) 3 hours credit. Prerequisites: GEO 2003 and 2011. Concurrent enrollment: GEO 2031.
Principles and methods of optical crystallography and optical properties of minerals.

2031 **Optical Mineralogy Laboratory**
Use of the petrographic microscope for the identification of minerals in immersion liquids and in thin sections.

2063 **Paleontology**
(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, 1023 and 1031. Concurrent enrollment: GEO 2071.

2071 **Paleontology Laboratory**
(0-3) 1 hour credit. Prerequisites: GEO 1003, 1011, 1023 and 1031. Concurrent enrollment: GEO 2063.
Study of fossil specimens, collection and preparation techniques.

3043 **Petrology**
(3-0) 3 hours credit. Prerequisites: GEO 2023 and 2031. Concurrent enrollment: GEO 3052.
Description, classification, occurrence, and origin of igneous, metamorphic, and sedimentary rocks.

3052 **Petrology Laboratory**
(0-4) 2 hours credit. Prerequisites: GEO 2023 and 2031. Concurrent enrollment: GEO 3043.
Laboratory study of rocks in hand specimen and thin section.

3083 **Stratigraphy**
(3-0) 3 hours credit. Prerequisites: GEO 2063 and 2071.
Application of geologic principles to the interpretation of rocks formed at or near the surface of the earth. Field trips required.

3103 **Structural Geology**
(3-0) 3 hours credit. Prerequisites: GEO 3043 and 3052. Concurrent enrollment: GEO 3111.
Response of earth materials to natural stresses. Description and origin of geologic structures.

3111 **Structural Geology Laboratory**
(0-2) 1 hour credit. Prerequisites: GEO 3043 and 3052. Concurrent enrollment: GEO 3103.
Laboratory study of geologic structures using maps, cross-sections, air photos, and descriptive geometric and stereographic methods.
3123 Sedimentary Geology
(3-0) 3 hours credit. Prerequisites: GEO 3043, 3052, and 3083. Concurrent enrollment: GEO 3131.
Processes of erosion, transportation and deposition that transform the surface of the continents and form bodies of sedimentary rock and their primary structures. Depositional systems and modeling are a significant area of study. Field trips required.

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

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

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

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

3182 Geology of Energy Resources
(2-0) 2 hours credit. Prerequisites: GEO 3103, 3111, 3123, and 3131. Concurrent enrollment: GEO 3191.
Geology of petroleum, natural gas, coal, uranium; geothermal energy sources.

3191 Geology of Energy Resources Laboratory
(0-3) 1 hour credit. Prerequisites: GEO 3103, 3111, 3123, and 3131. Concurrent enrollment: GEO 3182.
Laboratory studies of samples, maps and logs. Preparation of sample logs and subsurface maps.

3943 Field Methods in Geology
(0-9) 3 hours credit. Prerequisite or concurrent enrollment in 3083, 3123, 3131, 3103, 3111, and consent of instructor.
Use of surveying methods and topographic and air photo bases for geologic mapping. Description, recording, and interpretation of field relationships. Field trips required.

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

4023 Engineering Geology
(3-0) 3 hours credit. Prerequisites: PHY 1904 and 1911.
Geologic factors in the construction of large structures and excavations. Physical properties of natural minerals. Case studies.

4063 Principles of Environmental Geology
(3-0) 3 hours credit. Prerequisites: GEO 1003 and 1011.
Geologic factors important to city and regional planning. Land capability studies; geologic hazards.

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

4623 Groundwater Hydrology  
(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, and PHY 1904. 
Hydrologic cycle and the theory of underground water. Recharge and discharge of aquifers; water quality; exploration and development of ground water supplies.

4946 Field Geology  
(0-17) 6 hours credit. Prerequisite: GEO 3943 and consent of instructor. 
Field mapping and measurements during a six-week period in summer. Field trips required.

COURSE DESCRIPTIONS  
APPLIED PHYSICS  
(PHY)

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

1803 Physics for Life Sciences I  
(3-0) 3 hours credit. Prerequisite: Working knowledge of high school algebra, trigonometry, and geometry. Concurrent enrollment in PHY 1811 recommended. 
The principles of physics with applications and problem solving useful to biology and pre-medical students. Mechanics, heat and fluids.

1811 Physics for Life Sciences I Laboratory  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1803. Laboratory to accompany PHY 1803.

1823 Physics for Life Sciences II  
(3-0) 3 hours credit. Prerequisite: PHY 1803. Concurrent enrollment in PHY 1831 recommended. 
The principles of physics with applications and problem solving useful to biology and pre-medical students. Electricity and magnetism, wave phenomena, optics and modern physics.

1831 Physics for Life Sciences II Laboratory  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1823. Laboratory to accompany PHY 1823.

1904 Technical Physics I  
(4-0) 4 hours credit. Prerequisite or concurrent enrollment: MAT 1214. Concurrent enrollment: PHY 1911 is recommended. 
The basic concepts and methods of physics. Mechanics, heat, and fluids.

1911 Technical Physics I Laboratory  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1904. Laboratory to accompany PHY 1904.

1924 Technical Physics II  
(4-0) 4 hours credit. Prerequisite: PHY 1904. Prerequisite or concurrent enrollment: MAT 1223. Concurrent enrollment in PHY 1931 is recommended. 
A continuation of PHY 1904. Electricity and magnetism, wave phenomena and elements of modern physics.

1931 Technical Physics II Laboratory  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PHY 1924. Laboratory to accompany PHY 1924.
2002 Workshop in Applied Physics
(1-3) 2 hours credit. Prerequisite: PHY 1924.

2223 Musical Acoustics
(3-0) 3 hours credit. 1 year Music Theory desirable.
Vibrating systems, sound waves, sound phenomena, musical instruments, and basic concepts of audio electronics.

2403 Electronics
(3-0) 3 hours credit. Prerequisite: PHY 1924. Concurrent enrollment in PHY 2412 is strongly recommended.
AC circuits. The properties and application of diodes, transistors, digital and analog integrated circuits. Practical applications to electronic circuits are stressed.

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

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

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

3203 Dynamics
(3-0) 3 hours credit. Prerequisite: PHY 1924. Prerequisite or concurrent enrollment: MAT 2213.
Kinematics and dynamics of systems of particles, rigid body motion. Applications are emphasized.

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

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

3283 Thermal Physics
(3-0) 3 hours credit. Prerequisites: PHY 1924, CHE 2003 and MAT 1223.

3293 Statistical Mechanics
(3-0) 3 hours credit. Prerequisites: PHY 1924, CHE 3203 or PHY 3283 and MAT 2213.

3313 Materials Physics
(3-0) 3 hours credit. Prerequisite: PHY 3103.
Crystalline structures, the electron and phonon conditions to the thermal, electrical and optical properties of crystalline materials. Superconductivity.

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

3363 Biophysics
(3-0) 3 hours credit. Prerequisites: BIO 1103, CHE 2003, PHY 1823 or PHY 1924, and MAT 1223.
Study of biological systems from the physicist's point of view; introduction to atomic structure, molecular bonds, concepts of molecular biophysics, macro-molecules, survey of physical experimental techniques in molecular biophysics.

3383 General Geophysics
(3-0) 3 hours credit. Prerequisites: GEO 1003, 1011, PHY 1924 and consent of instructor. Physics of the earth's interior, plate tectonics, geomagnetism, gravity and heat flow.

3423 Electricity and Magnetism I
(3-0) 3 hours credit. Prerequisite: PHY 1924. Prerequisite or concurrent enrollment: MAT 2213. Vector calculus, Electrostatics, Magnetostatics, Faraday's Law, and Ohm's Law.

3433 Introduction to the Theory of Solid State Electronics
(3-0) 3 hours credit. Prerequisite: PHY 2403 and PHY 3313 or consent of instructor. Principles of intrinsic and extrinsic semiconductors. The theory of solid state devices.

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

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

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

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

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

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

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

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

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

4383 Exploration Geophysics
(3-0) 3 hours credit. Prerequisite: PHY 3383. Concurrent enrollment: PHY 4391. Principles of geophysical prospecting. Magnetic, gravity and seismic methods.

4391 Exploration Geophysics — Laboratory
(0-3) 1 hour credit. Concurrent enrollment: PHY 4383. Laboratory and field studies of seismic methods. Seismic instrumentation.
4401 Seismic Data Processing Laboratory
(0-3) 1 hour credit. Concurrent enrollment: PHY 4413.
Computer processing of seismic data.

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

4413 Seismic Data Processing
(3-0) 3 hours credit. Prerequisite: PHY 4383 and CS 1073.
Introduction to computer methods, filtering, correlating, analysis, and display of seismic
records. Wave propagation analysis for stratified media.

COURSE DESCRIPTIONS
APPLIED SCIENCE
(AS)

3213 Mechanics of Solids
(3-0) 3 hours credit. Prerequisites: AS 2203 and CHE 2003.
Internal forces and deformations in solids; stress; strain in elastic and plastic solids;
application to simple engineering problems.

3241 Materials Laboratory
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: AS 3213.
Laboratory study of principles of mechanics including stress and strain in elastic and
plastic solids.

3293 Thermodynamics I
(3-0) 3 hours credit. Prerequisites: PHY 1924, CHE 2003, and MAT 2213.
Heat, kinetic theory of gases, laws of thermodynamics and their practical applications to
thermodynamic devices including engines.

3503 Alternative Energy Sources
(3-0) 3 hours credit. Prerequisites: PHY 1924 and CHE 2003.
Solar, nuclear, wind, geothermal and tidal energy. Energy storage problems. Principles,
current technology and economic considerations.

3663 Fluid Mechanics
(3-0) 3 hours credit. Prerequisites: AS 2203 and MAT 1223.
Fluid properties; fluid statics, concepts and equations of fluid flow; similitude; viscous
effects; compressible fluid flow.

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

4923 Special Project
3 hours credit. Prerequisite: Consent of Division Director.
A special studies laboratory research or readings project resulting in a report. Limited to
students in their final year of undergraduate study.

4931-3 Practicum In Applied Science
1-3 hours credit. Prerequisite: Consent of Division Director.
A program of research and/or supervised applications of theory in a research, industrial
or government environment. This course is taught on a credit/no credit basis only. Stu-
dents completing this course will receive a grade of CR or NC.

4951-3 Special Studies In Applied Science
1-3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not
often available as part of the regular course offerings. Special Studies courses may be
repeated for credit when the topics vary, but not more than 6 hours within any one
discipline will apply to a bachelor's degree.
COURSE DESCRIPTIONS
POLYMER SCIENCE
(PS)

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

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

3623 Polymer Science II
(3-0) 3 hours credit. Prerequisite: CHE 3003 or consent of instructor.
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.

3632 Polymer Science II Laboratory
(0-6) 2 hours credit. Prerequisite or concurrent enrollment: PS 3623.
Laboratory projects illustrating and extending the concepts discussed in PS 3623.

3643 Natural and Synthetic Organic Polymers
(3-0) 3 hours credit. Prerequisites: PS 3603 and CHE 3003.
Preparation, structure and properties of addition and condensation polymers; polymerization by ring opening; block and graft polymers. Structure and properties of cellulose, proteins, rubber and their derivatives.

3651 Natural and Synthetic Organic Polymers Laboratory
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PS 3643.
Laboratory projects illustrating and extending the concepts discussed in PS 3643.

4623 Coatings Technology
(3-0) 3 hours credit. Prerequisite: PS 3623.
Convertible and nonconvertible coatings; solvents, plasticizers, lacquers, varnishes, formulation, pigmentation; film properties, chemical resistance, adhesion, hardness, flexibility, abrasion resistance, strength, color, opacity gloss; electrocoating; radiation and photo-curing. Pigmented coatings; extender pigments; decorative paints and industrial finishes; corrosion and chemical resistant paint systems.

4643 Polymer Processes
(3-0) 3 hours credit. Prerequisite: PS 3623.
Fundamentals of extrusion, injection, compression and blow molding, fiber spinning, calendaring and film formation; mixing processes; heat and mass transfer; elastic phenomena; simple flow models and stability of flow; process development and design.

4653 Polymer Technology
(3-0) 3 hours credit. Prerequisites: PS 3643 and 3651.
Finishing of polymers; thermosets; molding powders, laminates; polymer foams; coatings, drying oils, alkyds, epoxy resins, urethanes, natural and synthetic rubber processing; vulcanization and oxidation of polyolefins and polydienes; polymer latices. Film and fiber formation; melt, wet and dry spinning, orientation; adhesion; adhesive systems, polymer-plasticizer interaction, polymer-fiber interactions, reinforced systems, packaging materials.

4661 Polymer Technology Laboratory
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: PS 4653.
Laboratory projects illustrating and extending the concepts discussed in PS 4653.

4703 Organic Chemistry of Coatings
(3-0) 3 hours credit. Prerequisites: PS 3623 and CHE 3003.
Chemistry of autoxidation, glyceride oils; varnishes; and resins, including alkyd, epoxy,
amino and phenol formaldehyde, rubber and silicone resins; acrylic and vinyl coatings; polyurethanes and copolymers. Radiation curing, electrodeposition, photo-curable coatings.

**4743 Industrial and Commercial Applications of Polymers**

(3-0) 3 hours credit. Prerequisite: PS 3623. Mechanical, electrical and thermal properties of engineering plastics; applications as materials of construction; polymers in biology and biomedical engineering; space technology; specialty polymers for high temperature applications, environmental effects on polymers; rain erosion, weathering, corrosive environment, biological environment; radiation effects.

**BACHELOR OF SCIENCE DEGREE IN CHEMISTRY**

The minimum number of semester hours required for this degree, including the 42 semester hours of General Education Requirements, is 130. All candidates for the degree must complete:

A. 38 semester hours of required courses in Chemistry.

- CHE 1103 Introductory Chemistry
- CHE 2003 Chemical Principles
- CHE 2012 Inorganic Qualitative and Quantitative Analysis
- CHE 2203 Organic Chemistry I
- CHE 2242 Organic Chemistry I Laboratory
- CHE 3003 Organic Chemistry II
- CHE 3022 Organic Chemistry II Laboratory
- CHE 3103 Analytical Chemistry
- CHE 3203 Physical Chemistry I
- CHE 3212 Physical Chemistry Laboratory
- CHE 3223 Physical Chemistry II
- CHE 3232 Instrumental Analysis
- CHE 3263 Inorganic Chemistry I
- CHE 4923 Special Project in Chemistry or CHE 4913 Independent Study
- CHE 4971 Proseminar

B. 15 additional semester hours of approved elective courses.

1. 6 semester hours to be selected from:
   - CHE 4243 Organic Chemistry III
   - CHE 4253 Physical Chemistry III
   - PS 3603 Polymer Science I or PS 3623 Polymer Science II

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

C. 26 semester hours of *support work* in Science and Mathematics.

1. Required courses are:
   - MAT 1214 Calculus I
   - MAT 1223 Calculus II
   - MAT 2213 Calculus III or CS 1723 Data Structures I
   - PHY 1904 Technical Physics I
   - PHY 1911 Technical Physics I Laboratory
   - PHY 1924 Technical Physics II
   - PHY 1931 Technical Physics II Laboratory

---

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

Students seeking teaching certification should consult the Undergraduate Certification Programs in Education brochure for information.
2. 6 additional hours of elective work are required in courses in the College of Sciences and Mathematics, as approved by the Advisor.

D. Three (3) semester hours minimum in computer science.
   - CS 1073 Introductory Computer Programming for Scientific Applications
   - or
   - CS 1713 Introduction to Computer Science and
   - CS 1711 Introduction to Computer Science Laboratory

E. 6 semester hours of electives.

COURSE DESCRIPTIONS

CHEMISTRY

(CHE)

1003 General Chemistry for Allied Health Sciences
(3-0) 3 hours credit. Prerequisite: Concurrent enrollment in CHE 1111.
Introduction to atomic structure, chemical bonding, stoichiometry, states of matter, inorganic chemical reactions, acids and bases. For majors in occupational theory, prenursing, and dental hygiene. May not be applied to a major in chemistry, biology, or medical technology.

1103 Introductory Chemistry
(3-0) 3 hours credit. Concurrent enrollment in CHE 1122 and MAT 1183 is recommended.
An introduction to descriptive inorganic chemistry and atomic-molecular structure. Including such fundamental concepts as the periodic system of elements, valency, chemical bonding, reactions and reaction mechanisms, stoichiometry, equilibria, acids and bases, thermochemistry, molecular-kinetic theory, and states of matter.

1111 General Chemistry Laboratory for Allied Health Sciences
(0-4) 1 hour credit. Prerequisite: Concurrent enrollment: CHE 1003.
Introduction to chemical laboratory techniques. For majors in occupational therapy, prenursing, and dental hygiene. May not be applied to a major in chemistry, biology, or medical technology.

1122 Introductory Chemistry Laboratory Workshop
(1-4) 2 hours credit. Prerequisite or concurrent enrollment: CHE 1103.
An introduction to chemical problem solving and the basic operations of the chemical laboratory; and a survey of inorganic chemical reactions. This course consists of problem sessions, lecture-demonstrations, and/or laboratory experience.

2003 Chemical Principles
(3-0) 3 hours credit. Prerequisite: CHE 1103. Primarily for science majors.
Elementary inorganic and physical chemistry: descriptive inorganic chemistry, coordination chemistry, solutions and electrolytes, redox processes, elementary thermodynamics, chemical kinetics, and elementary electrochemistry.

2012 Inorganic Qualitative and Quantitative Analysis
(1-5) 2 hours credit. Prerequisite or concurrent enrollment: CHE 2003.
Techniques of qualitative and quantitative chemical analysis, illustrated primarily via inorganic chemical systems and their reactions.

2103 Elementary Organic and Biochemistry
(3-0) 3 hours credit. Prerequisites: CHE 1003 and 1111. May not be applied to a major in chemistry.
A survey of the structures and reactions of some important functional groups of organic chemistry. The relationship of these functional groups to the chemistry of lipids, carbohydrates, nucleic acids and proteins.

2111 Organic and Biochemistry Laboratory
(0-4) 1 hour credit. Prerequisite or concurrent enrollment: CHE 2103. May not be applied to a major in chemistry.
Laboratory examination of the properties of some simple organic and biological chemicals; solubility, crystallization, organic reactions, titration, enzyme action, sugars, vitamins.
2123 Fundamentals of Organic Chemistry
(3-0) 3 hours credit. Prerequisites: CHE 2003 and 2012. Concurrent enrollment in CHE 2131 is required. May not be applied to a major in chemistry.
A one semester course designed to provide elementary study of the structure of organic compounds and the reactions of organic functional groups.

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

2203 Organic Chemistry I
(3-0) 3 hours credit. Prerequisites: CHE 2003 and 2012. Primarily for chemistry, pre-med and science majors.
An elementary study of structure, stereochemistry, reactions, and reaction mechanisms associated with organic compounds.

2242 Organic Chemistry I Laboratory
(1-5) 2 hours credit. Prerequisite or concurrent enrollment: CHE 2203.
Qualitative analysis and determination of the physical constants of organic compounds. Separation, identification and elementary synthesis of organic compounds. Laboratory techniques (crystallization, distillation, chromatographic) and spectroscopic techniques (IR, NMR, MS) are emphasized.

3003 Organic Chemistry II
(3-0) 3 hours credit. Prerequisite: CHE 2203; Prerequisite or concurrent enrollment: CHE 2242.
Continuing study of fundamentals of structure, reactions and reaction mechanisms of phosphorus and sulphur; poly-functional organic compounds. A continuation of CHE 2203.

3022 Organic Chemistry II Laboratory
(1-5) 2 hours credit. Prerequisite: CHE 2242. Prerequisite or concurrent enrollment: CHE 3003 or consent of instructor.
Quantitative and continuing qualitative study of organic reactions and molecular structure through functional group interactions and spectroscopic techniques. Simple and multi-step syntheses of organic compounds.

3103 Analytical Chemistry
(2-5) 3 hours credit. Prerequisites: CHE 2003 and 2012.
A detailed study of wet chemical and basic instrumental analysis including gravimetric, volumetric, spectrophotometric determinations.

3203 Physical Chemistry I
(3-0) 3 hours credit. Prerequisites: CHE 2003, 2012, MAT 1223, PHY 1924, and 1931; at least one semester of organic chemistry is also recommended.
States of matter, gas laws, equations of state, inter-molecular interactions; thermodynamics and physical equilibria, elements of molecular-kinetic theory and statistical mechanics; physico-chemical properties of solutions, chemical equilibria, phase equilibria, and changes of state.

3212 Physical Chemistry Laboratory
(0-6) 2 hours credit. Prerequisite: Concurrent enrollment CHE 3203.
Experimental study of thermodynamics and electrochemistry, spectroscopy, and reaction kinetics.

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

3232 Instrumental Analysis
(0-6) 2 hours credit. Prerequisites or concurrent enrollment: CHE 3022, 3212, and 3223.
Electrochemical methods; use of modern spectrometric and chromatographic instrumentation in separation, purification, and/or quantitative characterization of chemical systems.
3263 **Inorganic Chemistry**  
(3-0) 3 hours credit. Prerequisite: CHE 3203.  
A study of the elements and their periodic properties; acid-base theory, crystalline state, coordination chemistry, non-aqueous solvents and other advanced topics.

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

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

3373 **Geochemistry**  
(3-0) 3 hours credit. Prerequisite: CHE 2003 or consent of instructor.  
A survey of geochemical processes and the distribution of elements in the earth. Application of chemical methods and data to the solution of geologic problems.

4223 **Advanced Biochemistry**  
(3-0) 3 hours credit. Prerequisites: BIO 3513, 3521 and CHE 3003, 3022.  
Chemical aspects of regulation and control mechanisms; membrane-related phenomena; oxidative phosphorylation and photosynthesis; transport mechanisms; contractility of muscle.

4231 **Advanced Biochemistry Laboratory**  
(0-3) 1 hour credit. Prerequisite or concurrent enrollment: CHE 4223. Applications of UV-visible and NMR spectroscopy, electrophoresis, gas chromatography, mass spectrometry and other physical techniques to biochemistry.

4243 **Organic Chemistry III**  
(3-0) 3 hours credit. Prerequisites: CHE 3003 and 3022; CHE 3203 or consent of instructor.  

4253 **Physical Chemistry III**  
(3-0) 3 hours credit. Prerequisites: CHE 3003, 3223 and 3232; or consent of instructor.  
Relations between structure of molecules and physico-chemical properties of gases, liquids and solids — quantum mechanical and statistico-thermodynamical approach.

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

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

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

4373 **Spectral Studies**  
(3-0) 3 hours credit. Prerequisite: CHE 3022.  
Identification of functional groups and the determination of the structure of compounds by spectral techniques including IR, NMR, mass spectroscopy and UV-Vis absorption spectroscopy; basic theory of spectral measurements with emphasis on practical applications.
4403 Chemistry of Heterocyclic Compounds  
(3-0) 3 hours credit. Prerequisite: CHE 3003 or consent of instructor.  
The chemistry of nitrogen, oxygen, and sulfur heterocycles. Five-membered and six­
membered ring systems with one and more than one heteroatom. Applications in the field  
of synthetic drugs.

4603 Synthesis and Biosynthesis of Natural Products  
(3-0) 3 hours credit. Prerequisite: CHE 4373, 4243, and/or BIO 3513 are recommended.  
Comparison of chemical and biochemical formations and transformations for several  
classes of naturally occurring compounds such as steroids, terpenoids, alkaloids, and  
other natural products of chemical or biological importance.

4911-3 Independent Study  
1-3 hours credit. Prerequisite: Permission in writing (form available).  
Independent reading, research, discussion, and/or writing under the direction of a faculty  
member. For students needing specialized work. May be repeated for credit, but not  
more than 6 hours will apply to the bachelor's degree.

4923 Special Project in Chemistry  
3 hours credit. Prerequisite: Consent of Division Director.  
A special laboratory research or library readings project under the direction of a faculty  
member, resulting in a report, limited to students in their final year of undergraduate  
study.

4931-3 Internship in Applied Chemical Operations  
1-3 hours credit. Prerequisites: CHE 3232, 3252, and consent of Division Director.  
Practical introduction to industrial and/or similar applied chemistry operations, via super­
vised extracollegiate internship, resulting in a report. This course is taught on a credit/no  
credit basis only. Students completing this course will receive a grade of CR or NC.

4951-3 Special Studies in Chemistry  
1-3 hours credit. Prerequisite: upper division standing and consent of instructor.  
An organized course offering the opportunity for specialized study not normally or not  
often available as part of the regular course offerings. Special Studies Courses may be  
repeated for credit when the topics vary, but not more than 6 hours within any one  
discipline will apply to a bachelor's degree.

4971 Proseminar  
(0-3) 1 hour credit. Prerequisites: CHE 3003 and CHE 3203.  
Oral reports and current publications in chemistry and chemical technology and the  
utilization of important chemical reference materials and periodicals. May be repeated  
for credit when topics vary, with consent of the Division Director.

COURSE DESCRIPTIONS  
ASTRONOMY  
(AST)

1013 Introduction to Astronomy I  
(3-0) 3 hours credit.  
A descriptive course including the development of astronomy, and its methods, the mo­
tions, laws and evolution of the solar system. Occasional evening viewing sessions are  
held.

1023 Introduction to Astronomy II  
(3-0) 3 hours credit. Prerequisite: AST 1013 or consent of instructor.  
The general properties and types of stars, unusual stellar objects such as quasars and  
black holes, galaxies, evolution and cosmology. Occasional evening viewing sessions  
are held.

1031 Introduction to Astronomy Laboratory  
(0-2) 1 hour credit. Prerequisite: AST 1013 or consent of instructor.  
Exercises in the use of the telescope and certain other astronomical instruments to  
include simple observations, measurement and photography.
COURSE DESCRIPTIONS
ENVIRONMENTAL MANAGEMENT
(ENV)

2013  Introduction to Environmental Systems
(3-0) 3 hours credit.
An introduction to the concept and challenge of man-machine-community interrelationships within both the natural and man-made environment. Attention to environmental systems and their importance.

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

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

4603  Environmental Quality Analysis
(2-3) 3 hours credit. Prerequisite: CHE 2003.
The procedures and instrumentation for the analysis of air, water, and soils. Environmental data acquisition and basic analysis for the interpretation and characterization of environmental quality.
DIVISION OF ENGINEERING

The Division of Engineering offers a Bachelor of Science Degree in Civil Engineering, a Bachelor of Science Degree in Electrical Engineering, and a Bachelor of Science Degree in Mechanical Engineering. Each of these degree programs is designed to provide students with a strong foundation in science and mathematics coupled with a strong program in engineering analysis, design, synthesis, and evaluation.

DEGREE REQUIREMENTS

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

II. Engineering Core Courses
   All degree candidates in the Division of Engineering must complete the following 43 (or 44) semester hours of required courses.
   - EGR 1103 Introduction to Engineering
   - EGR 1802 Engineering Graphics
   - EGR 2203 Statics
   - CHE 1103 Introductory Chemistry
   - CHE 2003 Chemical Principles
   - CS 1073 Introductory Computer Programming for Scientific Applications or
   - CS 1713 Introduction to Computer Science and
   - CS 1711 Introduction to Computer Science Laboratory
   - ENG 2413 Technical Writing
   - MAT 1214 Calculus I
   - MAT 1223 Calculus II
   - MAT 2213 Calculus III
   - MAT 3243 Calculus for Applications
   - PHY 1904 Technical Physics I
   - PHY 1911 Technical Physics I Lab
   - PHY 1924 Technical Physics II
   - PHY 1931 Technical Physics II Lab

BACHELOR OF SCIENCE DEGREE IN CIVIL ENGINEERING

The minimum number of semester hours required for this degree is 136.

I. General Education Requirements 42
II. Engineering Core Courses 43
III. Courses in Civil Engineering 51

TOTAL 136

A. Required Courses (45 hours)
   - AS 3213 Mechanics of Solids
   - AS 3241 Materials Laboratory
   - AS 3293 Thermodynamics I

---

26Computer Engineering Option
27The student who is not prepared to begin MAT 1214 must take MAT 1093, Precalculus.
BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

AS 3663  Fluid Mechanics
CE 3113  Structural Analysis
CE 3213  Reinforced Concrete Design

or

CE 3233  Steel Design
CE 4113  Transportation Systems
CE 4213  Soil Mechanics
CE 4603  Fundamentals of Hydraulic Engineering
CE 4612  Hydraulic Engineering Laboratory
CE 4633  Water and Wastewater Treatment
CE 4813  Engineering Design
EGR 4713  Engineering Economic Analysis
GEO 4023  Engineering Geology
ME 3243  Materials Engineering
PHY 3203  Dynamics

B. Approved Technical Electives (6 hours)

BACHELOR OF SCIENCE DEGREE IN ELECTRICAL ENGINEERING

The minimum number of semester hours required for this degree is 136.

I. General Education Requirements 42
II. Engineering Core Courses 43 (or 44)
III. Electrical Engineering Core Courses 36
IV. Option Courses
   Electrical Engineering Option 15
   Computer Engineering Option 14

TOTAL 136

A. Electrical Engineering Core
The following 30 semester hours are required for a Bachelor of Science Degree in Electrical Engineering.

EE 2113  Introduction to Electronics
EE 2424  Network Theory I
EE 3113  Electrical Engineering Lab I
EE 3423  Network Theory II
EE 3213  Electromagnetic Engineering
EE 3313  Electronic Circuits I
EE 4313  Electronic Circuits II
EE 4413  Introduction to Automatic Control
EGR 4713  Engineering Economic Analysis
SD 2812  Digital Circuits Design I Laboratory
SD 2815  Digital Circuits Design I
SD 3823  Data Acquisition

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

(1) Basic Electrical Engineering Option (15 hours)
(a) Required Courses (9 hours)
   SD 3833  Real-time Digital Control
   SD 3853  Instrumentation Circuits Design
   EE 4113  Electrical Engineering Lab II
(b) Approved Technical Electives (6 hours)

(2) Computer Engineering Option (14 hours)

CS 1723 Data Structures I
SD 2832 Digital Circuits Design II Laboratory
SD 2833 Digital Circuits Design II
SD 3843 Minicomputer Architecture
SD 4803 Microprocessor Lab I

BACHELOR OF SCIENCE DEGREE IN MECHANICAL ENGINEERING

The minimum number of semester credit hours required for this degree is 137.

I. General Education Requirements 42
II. Engineering Core Courses 43
III. Courses in Mechanical Engineering 52

TOTAL 137

A. Required Courses (49 hours)

AS 3213 Mechanics of Solids
AS 3241 Materials Laboratory
AS 3293 Thermodynamics I
AS 3503 Alternative Energy Sources
AS 3663 Fluid Mechanics
CE 4603 Fundamentals of Hydraulic Engineering
CE 4612 Hydraulic Engineering Laboratory
EGR 4713 Engineering Economic Analysis
ME 3243 Materials Engineering
ME 3263 Materials Processing
ME 3313 Measurements and Instrumentation
ME 4293 Thermodynamics II
ME 4313 Heat Transfer and Rate Processes
ME 4813 Engineering Design
PHY 2403 Electronics
PHY 2411 Electronics Laboratory
PHY 3203 Dynamics
SD 3823 Data Acquisition

B. Approved Technical Electives (3 hours)

COURSE DESCRIPTIONS

ENGINEERING

(EGR)

1103 Introduction to Engineering
(3-0) 3 hours credit.
Engineering as a career. Case studies which illustrate the scope and nature of the professional activities of engineers. Alternative approaches to engineering problem solving and design through use of engineering principles. Credit may not be obtained for both AS 1103 and EGR 1103.

1802 Engineering Graphics
(1-3) 2 hours credit.
Freehand and instrument drawing; shape and size description; pictorial methods; freehand lettering; charts and graphs. Credit may not be obtained for both AS 1802 and EGR 1802.
2203 Statics  
(3-0) 3 hours credit. Prerequisites: PHY 1904 and MAT 1223.  
Vector algebra, force systems, free body diagrams. Engineering applications of equilibrium, centroids, moments of inertia. Credit may not be obtained for both AS 2203 and EGR 2203.

4713 Engineering Economic Analysis  
(3-0) 3 hours credit. Prerequisites: ECO 2023 and senior standing in the Division of Engineering.  
Techniques of economic analysis for engineering decisions, economic evaluation, mathematical models, risk analysis.

COURSE DESCRIPTIONS  
CIVIL ENGINEERING  
(CE)

3113 Structural Analysis  
(3-0) 3 hours credit. Prerequisites: AS 3213 and CS 1073.  
Forces and deflections in structural systems considering stationary and moving loads, exact and approximate methods.

3213 Reinforced Concrete Design  
(2-3) 3 hours credit. Prerequisites: CE 3113 and ME 3243.  
Ultimate strength theory and design for reinforced concrete members.

3233 Steel Design  
(2-3) 3 hours credit. Prerequisites: CE 3113 and ME 3243.  
Analysis and design of tension members, beams, columns and bolted or welded connections.

3673 Municipal and Rural Sanitation  
(3-0) 3 hours credit. Prerequisites: BIO 1213, CHE 2003, and upper-division standing.  
An examination of sanitation practices in rural and urban environments including insect and rodent control, swimming pool sanitation, rural water supply, food sanitation, and disease transmission. Credit cannot be earned for any two of AS 3673, BIO 3233, and CE 3673.

4113 Transportation Systems  
(3-0) 3 hours credit. Prerequisites: STA 3513 and credit or registration for EGR 4713.  
Planning, design, construction, operation and maintenance of transportation systems; concepts of various modes of transportation.

4213 Soil Mechanics  
(2-3) 3 hours credit. Prerequisite: AS 2203.  
Engineering properties of soils, settlement of embankments and foundations of structures, bearing capacity of foundations, laboratory measurements.

4603 Fundamentals of Hydraulic Engineering  
(3-0) 3 hours credit. Prerequisite: AS 3663 or consent of instructor.  
Examination of various components of the hydrologic cycle in the atmosphere and outer crust of the earth. Emphasis on surface waters through analysis of hydrologic data relating to rainfall, runoff, infiltration, and evaporation. Credit may not be obtained for both AS 4603 and CE 4603.

4612 Hydraulic Engineering Laboratory  
(0-4) 2 hours credit. Prerequisite or concurrent enrollment: CE 4603 or consent of instructor.  
Laboratory studies in static and dynamic fluid properties and phenomena. Credit may not be obtained for both AS 4612 and CE 4612.

4633 Water and Wastewater Treatment  
(3-0) 3 hours credit. Prerequisites: CHE 2003 and AS 3663 or consent of instructor.  
The application of chemical, biochemical, physical and mathematical processes to water treatment, wastewater treatment and pollution control. Credit may not be obtained for both AS 4633 and CE 4633.
4643 **Air Pollution and Industrial Hygiene**  
(3-0) 3 hours credit. Prerequisites: 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 in urban and industrial environments. Credit cannot be earned for any two of AS 4643, BIO 4493, or CE 4643.

4813 **Engineering Design**  
(1-6) 3 hours credit. Prerequisite: consent of instructor. Design and synthesis of engineering systems.

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

4951-3 **Special Studies in Civil Engineering**  
1-3 hours credit. Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours will apply to a bachelor’s degree.

---

**COURSE DESCRIPTIONS**

**ELECTRICAL ENGINEERING (EE)**

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

2424 **Network Theory I**  
(3-3) 4 hours credit. Prerequisites: PHY 1924 and credit or registration for MAT 3613. Basic network principles; steady state response to DC and AC signals; simple transient response; nodal and loop analysis. Credit may not be obtained for both PHY 2424 and EE 2424.

3113 **Electrical Engineering Laboratory I**  
(1-4) 3 hours credit. Prerequisites: CS 1073 and credit or registration for EE 3423 and EE 3313. Basic experimental methods, theory and practice of measurements, limitation of theoretical models, digital computer applications.

3213 **Electromagnetic Engineering**  
(3-0) 3 hours credit. Prerequisites: MAT 3613 and EE 2424. Analysis and design of electromagnetic systems; utilization of conductive, dielectric and magnetic materials in components; engineering applications of Maxwell’s equations to electrical and electromagnetic wave systems.

3313 **Electronic Circuits I**  
(3-0) 3 hours credit. Prerequisites: EE 2113 and credit or registration for EE 3423. Electronic devices in analog and digital circuits, power circuits, frequency response, tuned circuits, modulation and detection systems.

3423 **Network Theory II**  
(3-0) 3 hours credit. Prerequisites: EE 2424 and MAT 3613. Transient response of networks by Fourier and Laplace transform methods, frequency domain techniques and time domain techniques.
4113 Electrical Engineering Lab II
(1-4) 3 hours credit. Prerequisites: EE 3113 and credit or registration for EE 3213 and EE 4313.
Experimental solution of engineering problems including design, optimization, evaluation, and simulation; measurements in pulsed, UHF, and modulation systems.

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

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

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

4951-3 Special Studies in Electrical Engineering
1-3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours will apply to a bachelor’s degree.

COURSE DESCRIPTIONS
MECHANICAL ENGINEERING
(ME)

3243 Materials Engineering
(2-2) 3 hours credit. Prerequisites: CHE 1103, MAT 2213, and credit or registration for AS 3213.
Fundamental aspects of the structure, properties and behavior of engineering materials.

3263 Materials Processing
(2-3) 3 hours credit. Prerequisites: ME 3243 and PHY 3203.
Casting, joining, forming and machining; effects of processing on materials.

3313 Measurements and Instrumentation
(2-3) 3 hours credit. Prerequisites: STA 3513 and PHY 2403.
Fundamentals of measurement systems; standards, treatment of data; transducers, signal conditioning; strain, force, acceleration, pressure, temperature, fluid flow.

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

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

4813 Engineering Design
(1-6) 3 hours credit. Prerequisite: Consent of instructor.
Design and synthesis of engineering systems.

4911-3 Independent Study
1-3 hours credit. Prerequisite: Permission in writing (form available) of the instructor, the
student's Advisor, and the Division Director and Dean of the College in which the course is offered.

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

4951-3 Special Studies in Mechanical Engineering
1-3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when topics vary, but not more than 6 hours will apply to a bachelor's degree.
DIVISION OF MATHEMATICS, COMPUTER SCIENCE, AND SYSTEMS DESIGN

The division offers a Bachelor of Science Degree in Mathematics, Computer Science, and Systems Design in which the student may select one of six emphases: Actuarial Science, Computer Science, Mathematics, Statistics, Systems Design, or Distributed. It also offers a Bachelor of Science Degree in Mathematics designed for students interested in obtaining a secondary teaching certificate.

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

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 126.48

All candidates for the Bachelor of Science degree in Mathematics, Computer Science, and Systems Design, regardless of emphasis, must complete the following 26 semester hours of required courses (which includes the 3 hours of General Education Requirements in Mathematics, Computer Science, and Systems Design):

- The student who is not prepared to begin MAT 1214 must take MAT 1093, Pre-calculus.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT 1214</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MAT 1223</td>
<td>Calculus II</td>
</tr>
<tr>
<td>MAT 2213</td>
<td>Calculus II</td>
</tr>
<tr>
<td>MAT 2233</td>
<td>Matrix Algebra</td>
</tr>
<tr>
<td>STA 3513</td>
<td>Probability and Statistics</td>
</tr>
<tr>
<td>STA 3523</td>
<td>Statistical Methods</td>
</tr>
<tr>
<td>CS 1711</td>
<td>Introduction to Computer Science Laboratory</td>
</tr>
<tr>
<td>CS 1713</td>
<td>Introduction to Computer Science</td>
</tr>
<tr>
<td>CS 1723</td>
<td>Data Structures I</td>
</tr>
</tbody>
</table>

In addition, a candidate for the Bachelor of Science in Mathematics, Computer Science, and Systems Design degree must complete the course requirements for the emphasis declared by the candidate.

ACTUARIAL SCIENCE EMPHASIS

Additional Bachelor of Science in Mathematics, Computer Science, and Systems Design Degree Requirements for the actuarial science emphasis are:

A. The following 27 semester hours:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT 2913</td>
<td>Problems in Actuarial Science I</td>
</tr>
<tr>
<td>MAT 3613</td>
<td>Differential Equations I</td>
</tr>
<tr>
<td>MAT 3633</td>
<td>Numerical Analysis I</td>
</tr>
<tr>
<td>MAT 3923</td>
<td>Finance Mathematics</td>
</tr>
<tr>
<td>MAT 3933</td>
<td>Mathematics of Life Insurance</td>
</tr>
<tr>
<td>MAT 3953</td>
<td>Problems in Actuarial Science II</td>
</tr>
<tr>
<td>MAT 3963</td>
<td>Problems in Actuarial Science III</td>
</tr>
<tr>
<td>SD 4613</td>
<td>Operations Research I</td>
</tr>
<tr>
<td>SD 4623</td>
<td>Operations Research II</td>
</tr>
</tbody>
</table>

48Thirty-nine of the total semester hours required for the degree must be at the upper-division level.

Students seeking teacher certification should consult the Undergraduate Certification Programs in Education brochure for information.
B. An additional 9 semester hours chosen from among the following courses:

- CS 2733 Introduction to Computer Organization
- CS 2743 Data Structures II
- CS 3733 Systems Programming
- CS 3743 Data Base Management
- CS 4753 Operating Systems and Computer Architecture I

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

- STA 3313 Introduction to Sample Survey Theory and Methods
- STA 3433 Applied Non-Parametric Statistics
- STA 4643 Introduction to Stochastic Processes
- STA 4713 Applied Regression Analysis
- STA 4723 Design and Analysis of Experiments
- STA 4733 Statistical Design and Model Building

D. 16 semester hours of electives.

**COMPUTER SCIENCE EMPHASIS**

Additional Bachelor of Science in Mathematics, Computer Science, and Systems Design Degree Requirements for the computer science emphasis are:

A. The following 26 semester hours:

- CS 2733 Introduction to Computer Organization
- CS 2743 Data Structures II
- CS 3233 Discrete Mathematical Structures
- CS 3723 Programming Languages
- CS 3733 Systems Programming
- CS 3773 Programming Methodology
- CS 4753 Operating Systems and Computer Architecture I
- SD 2812 Digital Circuits Design I Laboratory
- SD 2813 Digital Circuits Design I

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

C. 23 semester hours of electives.

**MATHEMATICS EMPHASIS**

Additional Bachelor of Science in Mathematics, Computer Science, and Systems Design Degree Requirements for the mathematics emphasis are:

A. CS 3233 Discrete Mathematical Structures
   - MAT 3213 Foundations of Analysis

B. 18 semester credit hours chosen from the following courses:

   Students should follow one of these three suggested guidelines.
   i) Students desiring a broad background in mathematics should take at least 12 hours from Group I and 6 hours from Group II.
   ii) Students desiring a concentration which emphasizes pure mathematics should take at least 6 hours from Group I and 12 hours from Group II.
   iii) Students desiring a concentration which emphasizes applied mathematics should take all 18 hours from Group I.
STATISTICS EMPHASIS

Additional Bachelor of Science in Mathematics, Computer Science, and Systems Design Degree Requirements for the statistics emphasis are:

A. An additional 12 semester hours chosen from the following courses:
   - STA 3013 Multivariate Analysis for the Life and Social Sciences
   - STA 3313 Introduction to Sample Survey Theory and Methods
   - STA 3433 Applied Non-Parametric Statistics
   - STA 4643 Introduction to Stochastic Processes
   - STA 4713 Applied Regression Analysis
   - STA 4723 Design and Analysis of Experiments
   - STA 4733 Statistical Design and Model Building
   - STA 3813 Discrete Data Analysis and Bioassay

B. An additional 6 semester hours chosen from the following courses:
   - MAT 3213 Foundations of Analysis
   - MAT 3223 Complex Variables
   - MAT 3613 Differential Equations I
   - MAT 3923 Finance Mathematics
   - MAT 3933 Mathematics of Life Insurance
   - SD 4613 Operations Research I
   - SD 4623 Operations Research II
   - SD 4633 Simulation

C. Any 13 additional semester hours of approved elective courses in the Division of Mathematics, Computer Science, and Systems Design with a course number of 2000 or above.

D. 30 semester hours of electives.
SYSTEMS DESIGN EMPHASIS

Additional Bachelor of Science in Mathematics, Computer Science, and Systems Design Degree Requirements for the systems design emphasis are:

A. The following 22 semester hours:
   - SD 2812 Digital Circuits Design I Laboratory
   - SD 2813 Digital Circuits Design I
   - SD 2832 Digital Circuits Design II Laboratory
   - SD 2833 Digital Circuits Design II
   - SD 3823 Data Acquisition and Distribution
   - SD 3833 Real-Time Digital Control
   - SD 3843 Minicomputer Systems Architecture
   - SD 4803 Microprocessor Laboratory I

B. An additional 9 semester hours chosen from the following courses:
   - CS 3723 Programming Languages
   - CS 3743 Data Base Management
   - CS 3773 Programming Methodology
   - CSD 4911-3 Independent Study
   - CSD 4953 Special Studies in Computer Science or Systems Design
   - SD 3853 Instrumentation Circuits Design
   - SD 3863 Real-Time Operating Systems for Minicomputers
   - SD 3873 Analog Simulation
   - SD 4813 Microprocessor Laboratory II
   - SD 4823 System Analysis
   - SD 4833 Optimal Control
   - SD 4853 Computer Interfaces
   - MAT 3633 Numerical Analysis I
   - MAT 3643 Numerical Analysis II

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

D. 27 semester hours of electives.

DISTRIBUTED EMPHASIS

Additional Bachelor of Science in Mathematics, Computer Science, and Systems Design Degree Requirements for the distributed emphasis are:

A. The following 32 semester hours:
   - CS 2733 Introduction to Computer Organization
   - CS 2743 Data Structures II
   - CS 3233 Discrete Mathematical Structures
   - CS 3723 Programming Languages
   - MAT 3243 Calculus for Applications
   - MAT 3613 Differential Equations I
   - MAT 3633 Numerical Analysis I
   - SD 2812 Digital Circuits Design I Laboratory
   - SD 2813 Digital Circuits Design I
   - SD 3823 Data Acquisition and Distribution
   - SD 4613 Operations Research I

B. Any 9 additional upper-division hours of approved elective courses in the Division of Mathematics, Computer Science, and Systems Design.

C. 20 semester hours of electives.
BACHELOR OF SCIENCE DEGREE IN MATHEMATICS

The minimum number of semester hours required for this degree, including the 42 hours of General Education Requirements, is 126. The student who is not prepared to begin MAT 1214 must take MAT 1093, Precalculus.

All candidates for the degree must complete:

A. 32 required semester hours listed below:

- CS 1711 Introduction to Computer Science Laboratory
- CS 1713 Introduction to Computer Science
- CS 1723 Data Structures I
- CS 3233 Discrete Mathematical Structures
- MAT 1214 Calculus I
- MAT 1223 Calculus II
- MAT 2213 Calculus III
- MAT 3213 Foundations of Analysis
- MAT 4263 Geometry
- STA 3513 Probability and Statistics
- STA 3523 Statistical Methods

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

C. 43 semester hours of electives chosen to satisfy the Teacher Certification Requirements.

COURSE DESCRIPTIONS

COMPUTER SCIENCE (CS)

1043 Computer Programming for Business Applications
(3-0) 3 hours credit. Prerequisite or concurrent enrollment: STA 1064.
Program development and testing; computer applications; plotting, solution of equations, probability distributions, random variate generation, matrix operations, numeric integration and differentiation and computing statistics. Students majoring in the Division of Mathematics, Computer Science, and Systems Design receiving credit for CS 1043 may not also receive credit for CS 1063 nor for CS 1073.

1063 Introduction to Problem-Solving and Programming
(3-0) 3 hours credit.
A problem-solving approach to computer programming. Stress is on problem definition, problem-solving techniques and algorithm development. Students majoring in the Division of Mathematics, Computer Science, and Systems Design receiving credit for CS 1063 may not also receive credit for CS 1043 nor for CS 1073.

1073 Introductory Computer Programming for Scientific Applications
(3-0) 3 hours credit. Prerequisite: MAT 1013 or MAT 1183.
Introductory programming. Sorting and ranking; plotting; numerical taxonomy. Solution of non-linear equations; linear regression. Solution of linear systems. Students majoring in the Division of Mathematics, Computer Science, and Systems Design receiving credit for CS 1073 may not also receive credit for CS 1063 nor for CS 1043.
1133 **Computer Literacy I**
(3-0) 3 hours credit.
An introduction to computers and information processing for those with no previous background; a study of the computer, its uses and social impact; introduction to computer programming. May not be applied to a major in Mathematics, Computer Science, and Systems Design.

1711 **Introduction to Computer Science Laboratory**
(0-2) 1 hour credit. Prerequisites: MAT 1013, 1063 or 1183. Concurrent enrollment: CS 1713.
Laboratory to accompany CS 1713. Credit cannot be earned for both CS 1711 and CS 1714.

1713 **Introduction to Computer Science**
(3-0) 3 hours credit. Prerequisite: MAT 1013, 1063 or 1183. Concurrent enrollment: CS 1711.
Introduction to basic concepts of computer science. Functional components of computers, data representation, problem solving methods, algorithm development, and programming using a high-level programming language. Credit cannot be earned for both CS 1713 and CS 1714.

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

2133 **Computer Literacy II**
(3-0) 3 hours credit. Prerequisite: CS 1133.
Advanced programming topics in BASIC; special emphasis on microcomputers in home and business applications. May not be applied to a major in Mathematics, Computer Science, and Systems Design.

2733 **Introduction to Computer Organization**
(3-0) 3 hours credit. Prerequisites: CS 1723. Concurrent enrollment: SD 2812 and 2813.
The characteristics of, and relationships between I/O devices, control units, and storage devices; the organization of modules into a system; the relationship between computer organization and software.

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

3133 **Computers and Society**
(3-0) 3 hours credit. Prerequisite: Any one of the following courses: CS 1043, 1063, 1073, 1133, or 1713, or consent of instructor.
Examination of some of the major issues faced by the use of computers in society including computers and the law, computers in business, computers in education, computers in science and engineering, and electronic fund-transfer and communications.

3233 **Discrete Mathematical Structures**
(3-0) 3 hours credit. Prerequisites: CS 1723 and MAT 2213.
Survey and development of theoretical tools suitable for describing algorithmic applications. Propositional logic and proofs, set theory, algebraic structures, groups, graphs, lattices, Boolean algebra, finite fields, and computability.

3321 **Topics in Problem Solving Using High Level Languages**
(1-0) 1 hour credit. Prerequisite: CS 1723.
Problem solving techniques using a high-level language. Languages will vary and include COBOL, FORTRAN, BASIC, PL/I, LISP, and SNOBOL. May be repeated for credit when topics vary, but not more than 3 hours will apply to the major.

3723 **Programming Languages**
(3-0) 3 hours credit. Prerequisites: CS 2733 and 2743.
An introduction to the philosophy and features of high-level programming languages;
elementary aspects of computer and run-time considerations, problem solving ability, syntax, semantics, and examples.

3733 Systems Programming
(3-0) 3 hours credit. Prerequisites: CS 2733 and 2743.
An introduction to system software. Internal representation of data and programs, addressing techniques, I/O, macros, and utilities; introduction to operating systems.

3743 Data Base Management
(3-0) 3 hours credit. Prerequisite: CS 2743.
Study of systems for management of large amounts of related data. Basic concepts, implementation approaches, user data models, commercially available systems.

3773 Programming Methodology
(3-0) 3 hours credit. Prerequisite: CS 2743.
Discussion of modular (structured) programming methods, programming style and program verification techniques.

3793 Introduction to Artificial Intelligence
(3-0) 3 hours credit. Prerequisites: CS 2743 and 3233.
Discussion of theorem proving by machine, computational linguistics, psychological modeling and computer games.

4133 Survey of Computer System Concepts
(3-0) 3 hours credit. Prerequisite: Programming experience or familiarity with the basics of computing.
A survey of some essential concepts of information structures and file systems, operating systems, programming languages, and architecture from a user’s point of view. May not be applied to a major in Mathematics, Computer Science and Systems Design.

4313 Automata, Computability and Formal Languages
(3-0) 3 hours credit. Prerequisite: CS 3233.
Discussion of abstract machines (finite state automata, pushdown automata and turing machines), formal grammars (regular, context-free and type 0) and the relationships between them.

4323 Analysis of Algorithms
(3-0) 3 hours credit. Prerequisites: CS 2743 and CS 3233.
Analysis of the performance of algorithms and discussion of programming techniques and data structures used in the writing of effective algorithms.

4383 Computer Graphics
(3-0) 3 hours credit. Prerequisites: CS 3773 and MAT 2233.
An introduction to two- and three-dimensional generative computer graphics. Display devices, data structures, mathematical transformations, and algorithms used in picture generation, manipulation, and display.

4713 Compiler Writing Laboratory
(3-0) 3 hours credit. Prerequisite: CS 3723.
An introduction to implementation of translators. Topics include formal grammars, scanners, parsing techniques, symbol table management, code generation, and code optimization.

4753 Operating Systems and Computer Architecture I
(3-0) 3 hours credit. Prerequisite: CS 3733.
A study of the relationship between operating systems and computer architecture. Instruction sets, memory organization and management, process management, multiprogramming systems, protection, and file systems.
1013 Algebra
(3-0) 3 hours credit.
Exponents, arithmetic and factorization of polynomials; rational expressions; negative and rational exponents; scientific notation; radicals; solving linear and quadratic equations; complex numbers; linear inequalities; absolute values; Cartesian coordinates, distance formula, linear equations, relations; functions, graphing functions. Credit cannot be earned for both MAT 1013 and MAT 1183 as MAT 1013 was formerly MAT 1183.

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

1033 Algebra with Calculus for Business
(3-0) 3 hours credit. Prerequisite: MAT 1013 or 1183 or the equivalent.
An introduction to business calculus with an emphasis on the algebra of functions. Concentration is on the algebraic manipulations of functions and includes volume and profit functions, both linear and quadratic; root finding and graphical analysis; differentiation and integration.

1063 Algebra for Scientists and Engineers
(3-0) 3 hours credit.
Algebraic expressions; equations, inequalities over the real numbers; relations, functions; exponentials and logarithmic functions; systems of linear equations and inequalities; matrices and determinants; complex numbers; polynomials; sequences, series, binomial expansion; mathematical induction; permutations, combinations.

1093 Precalculus
(3-0) 3 hours credit. Prerequisite: MAT 1063 or the equivalent.
Polynomial and rational functions, exponential functions, logarithmic functions, trigonometric functions. Formerly MAT 1092. Credit cannot be earned for both 1092 and 1093.

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

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

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

1214 Calculus I
(4-0) 4 hours credit. Prerequisite: MAT 1093 or the equivalent.
An introduction to the concepts of limit, continuity and derivative, mean value theorem, and applications of derivatives such as velocity, acceleration maximization and curve sketching; introduction to the Riemann integral and the fundamental theorem of calculus.

1223 Calculus II
(3-0) 3 hours credit. Prerequisite: MAT 1214.
Methods of integration, inverse trigonometric functions, applications of the integral, multiple integrals.

1993 Topics in Mathematics
(3-0) 3 hours credit. Consent of instructor.
Introductory study of a topic or topics in mathematics. May be repeated for credit when topics vary, but no more than 3 hours will apply to a bachelor's degree.
2213 Calculus III
(3-0) 3 hours credit. Prerequisite: MAT 1223.
Special areas of differential and integral calculus. Taylor series, power series, convergence tests, vectors, functions of several variables, partial derivatives.

2233 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.

2913 Problems in Actuarial Science I
(3-0) 3 hours credit. Prerequisite: MAT 2213. Prerequisite or concurrent enrollment: MAT 2233.
Problem solving in problems from advanced calculus and linear algebra which apply to actuarial science.

3113 Algebra for Elementary Teachers
(3-0) 3 hours credit. Prerequisite: MAT 1123. Open only to declared Elementary Education majors.
Areas of study from college algebra including linear and quadratic equations and inequalities, systems of equations, graphical methods.

3123 Geometry for Elementary Teachers
(3-0) 3 hours credit. Prerequisite: MAT 1123. Open only to declared Elementary Education majors.
Geometrical concepts with emphasis on an axiomatic, deductive approach to plane geometry; 3-dimensional and topological aspects.

3213 Foundations of Analysis
(3-0) 3 hours credit. Prerequisite: MAT 2213.
An opportunity for rigorous development of the foundations of real analysis; basic point set topology in \( \mathbb{R}^1 \) and \( \mathbb{R}^n \); compactness; connectedness; convergence; cardinality. Emphasis on theorem proving and mathematical rigor.

3223 Complex Variables
(3-0) 3 hours credit. Prerequisite: MAT 2213.
An introduction to complex variables including elementary functions, line integrals, power series, residues and poles and conformal mappings.

3233 Modern Algebra
(3-0) 3 hours credit. Prerequisite: MAT 2213.
An introduction to the concepts of modern algebra by way of the integers. Emphasis on theorem proving and mathematical rigor.

3243 Calculus for Applications
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Line integrals, Green's theorem, Stokes' theorem, Fourier series, Laplace transforms.

3613 Differential Equations I
(3-0) 3 hours credit. Prerequisite or concurrent enrollment in MAT 2233.
Basic notions of differential equations, solution of first order equations and linear equations with constant coefficients, n-th order initial value problems, power series solutions of differential equations.

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

3633 Numerical Analysis I
(3-0) 3 hours credit. Prerequisites: MAT 2233 and either CS 1073 or 1713.
Solution of linear and non-linear equations, curve-fitting, eigenvalue problems.

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

3923 Finance Mathematics
(3-0) 3 hours credit. Prerequisite: MAT 1214.
Analysis of the time value of money; preparation for parts of the actuarial examinations; determining the evaluation of flows of money, mortgage payments, bond amortization schedules, annuities, and related areas.

3933 Mathematics of Life Insurance
(3-0) 3 hours credit. Prerequisite: STA 3513.
Probability theory applied to problems of life insurance. Measurement of mortality; annuity and insurance benefits; reserve liabilities; expenses; gross premiums, asset shares, modified reserves, cash values; nonforfeiture options; distribution of surplus.

3953 Problems in Actuarial Science II
(3-0) 3 hours credit. Prerequisite: STA 3523 or concurrent enrollment.
Problem solving in probability and statistics applied to actuarial science.

3963 Problems in Actuarial Science III
(3-0) 3 hours credit. Prerequisite: MAT 3923 and 3633 or concurrent enrollment.
Problem solving in the theory of interest and in basic numerical analysis applied to actuarial science.

3973 Problems in Actuarial Science IV
(3-0) 3 hours credit. Prerequisite: MAT 3933 or concurrent enrollment.
Problem solving in life contingencies.

4113 Mathematical Subjects for Elementary Teachers
(3-0) 3 hours credit. Open only to declared Elementary Education majors.
Selected mathematical subjects of an advanced nature relevant to the modern elementary mathematics curriculum.

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

4213 Real Analysis I
(3-0) 3 hours credit. Prerequisite: MAT 3213 recommended.
An in-depth study of the calculus of functions of a single real variable; pointwise convergence; continuity; uniform convergence; differentiation; functions of bounded variation; Riemann-Stieltjes integration; interchange of limits.

4223 Real Analysis II
(3-0) 3 hours credit. Prerequisites: MAT 2233 and 4213.
An in-depth study of the calculus of functions of several real variables; differentiation; Jacobians; non-linear transformations; integration.

4233 Modern Abstract Algebra I
(3-0) 3 hours credit. Prerequisite: MAT 2213. CS 3233 recommended.
An in-depth study of groups and rings.

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

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

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

4273 Topology
(3-0) 3 hours credit. Prerequisite: MAT 2213.
Set theory including cardinal and ordinal numbers. Topological properties of the real line and metric spaces.

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

4951·3 Special Studies in Mathematics
1-3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies courses may be repeated for credit when the topics vary, but not more than 6 hours will apply to a bachelor’s degree.

COURSE DESCRIPTIONS

STATISTICS (STA)

1053 Basic Statistics
(3-0) 3 hours credit. Prerequisite: MAT 1013, 1033 or 1183.

1064 Basic Statistics for Business and Economics
(4-0) 4 hours credit. Prerequisite: MAT 1033.
Fundamental concepts and procedures of statistics and probability with business applications: descriptive and inferential statistics, regression and correlation, time series, index numbers. Use of computer library programs.

1993 Statistical Methods for the Life and Social Sciences
(3-0) 3 hours credit. Prerequisite: STA 1053 or 1064.
Point estimator properties, inference about the means and variances of two or more populations, categorical data analysis, linear regression, analysis of variance, nonparametric tests. Open to students of all disciplines.

3013 Multivariate Analysis for the Life and Social Sciences
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.
Matrix algebra preliminaries, the multivariate normal distribution, tests on means, discrimination analysis, cluster analysis, principle components, factor analysis. Use of computer library programs. Open to students of all disciplines.

3313 Introduction to Sample Survey Theory and Methods
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3513.
Basic tools, simple random sampling, stratified random sampling, ratio and regression estimates, systematic sampling, cluster sampling, unequal probability sampling, two-stage and multistage sampling, non-sampling errors.

3433 Applied Non-Parametric Statistics
(3-0) 3 hours credit. Prerequisite: STA 1993 or concurrent enrollment: STA 3523.

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

3523 Statistical Methods
(3-0) 3 hours credit. Prerequisite: STA 3513.

3813 Discrete Data Analysis and Bioassay
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.
4643 Introduction to Stochastic Processes  
(3-0) 3 hours credit. Prerequisite: STA 3513.  
Finite Markov chains including transition probabilities, classification of states, limit theorems; queuing theory, birth and death processes.

4713 Applied Regression Analysis  
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3513.  
An introduction to regression analysis with emphasis on practical aspects, fitting a straight line, examination of residuals, matrix treatment of regression analysis, fitting and evaluation of general linear models, non-linear regression.

4723 Design and Analysis of Experiments  
(3-0) 3 hours credit. Prerequisite: STA 1993 or concurrent enrollment: STA 3523.  
General concepts in the design and analysis of experiments; response variable, factors to be varied, quantitative and qualitative factors, fixed and random factors and how the factors are to be combined. The method of randomization to be used in the design, the order of experimentation, the mathematical model used to describe the experiment, computation of the test statistics and the interpretation of the results.

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

COURSE DESCRIPTIONS

SYSTEMS DESIGN

(3-0) 3 hours credit. Prerequisites: CS 1723 and MAT 1214, concurrent enrollment: SD 2812.


4733 Statistical Design and Model Building  
(3-0) 3 hours credit. Prerequisite: STA 1993 or 3523.  
Elements of model building. Fitting linear models to data. Factorial designs. Response surface methodology.
ory 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 2812, 2813, 3823 and PHY 1923.
Functional characteristics of state-of-the-art integrated operational amplifiers, regulated power supplies, digital-to-analog and analog-to-digital converters, isolation amplifiers, serial transmitters, design of hardware configurations to interface scientific and industrial instrumentation to a minicomputer.

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

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. Prerequisites: MAT 2213 and MAT 2233.
Introduction to analytical methods and models of operations research, with emphasis on optimization. Linear, integer and non-linear programming. Network analysis, including PERT and CPM. Introduction to dynamic programming.

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

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

4803 Microprocessor Laboratory I
(1-4) 3 hours credit. Prerequisite: SD 3843.
Principles of large-scale integration and very large-scale integration. The organization and systems architecture of state-of-the-art microprocessors. The integration of microprocessors with random-access memory, programmable read-only memory, peripheral controllers and I/O devices. Assemblers, compilers and operating systems for microprocessors.

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

4823 System Analysis
(3-0) 3 hours credit. Prerequisite: MAT 2213.

4833 Optimal Control
(3-0) 3 hours credit. Prerequisite: SD 4823.

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.
COMPUTER SCIENCE — SYSTEMS DESIGN / 265

COURSE DESCRIPTIONS
COMPUTER SCIENCE/SYSTEMS DESIGN
(CSD)

4901 Seminar in Computer Sciences and Systems Design
(1-0) 1 hour credit. Prerequisite: Upper-division classification.
Scheduled and impromptu presentations on subjects of interest presented by division
faculty and visiting lecturers. May be repeated for credit but no more than 3 hours will
apply toward the major.

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

4951-3 Special Studies in Computer Science or Systems Design
1-3 hours credit. Prerequisite: Consent of instructor.
An organized course offering the opportunity for specialized study not normally or not
often available as part of the regular course offerings. Special Studies courses may be
repeated for credit when topics vary, but not more than 6 hours will apply to a bachelor's
degree.