COLLEGE OF SCIENCE

Stanley C. Israel, Ph.D., Dean
Gregory B. Passty, Ph.D., Assistant Dean

Department Chairs

Biology .....Francis L. Rose, Ph.D.
Chemistry and Biochemistry.....James D. Irvin, Ph.D.
Computer Science.....Moonis Ali, Ph.D.
Mathematics.....Stanley G. Wayment, Ph.D.
Physics .....James R. Crawford, Ph.D.
Technology .....Robert Habingreither, Ph.D.

COLLEGE OF SCIENCE

The mission of the College of Science is threefold: to prepare students for careers in the natural or physical sciences, mathematics, computer science, or technology; to provide general scientific and mathematical backgrounds for non-science majors; and to prepare students for advanced training in professional or graduate schools. To accomplish its mission the College maintains an academic atmosphere conducive to excellence in teaching and research and enforces high standards of performance for faculty and students.

To ensure an understanding of basic scientific concepts, the College offers extensive opportunities for student participation. Students gain experience in laboratories, interact with the environment through field studies, conduct undergraduate research, and train in technologically advanced instrumentation. A combination of student participation, rigorous classroom instruction, and library research gives majors a competitive advantage in career advancement or in the selection of professional or graduate colleges. The non-science major is assured of adequate scientific knowledge to make informed decisions essential to citizens in a science-oriented, technological world.

The six academic departments in the College of Science are the departments of Biology, Chemistry, Computer Science, Mathematics, Physics, and Technology. Each department offers both the BA and BS degrees. In addition, the Technology department offers a BST (Bachelor of Science in Technology), and the BAAS (Bachelor of Applied Arts and Science). Majors include aquatic biology, botany, chemistry, computer science, engineering technology, general biology, general physiology, industrial technology, information systems management, manufacturing engineering, marine biology, mathematics, microbiology, physics, wildlife biology, and zoology. In addition, pre-professional programs of study are available in dentistry, medicine, engineering, and pharmacy. Secondary teacher certification may be incorporated into either the BA or BS degrees. Coursework in the geological sciences is available through the department of Biology.

The College of Science Advisement Center, located in Centennial Hall room 202, provides students with counseling on academic and administrative issues. Students are informed about matters related to academic majors and career possibilities, scholarships and awards within the College, the selection of appropriate courses, the choice of an educational program leading to a bachelor's degree, and participation in pre-professional programs. The Advisement Center is a resource for current and prospective students who are considering a science major or pre-professional program, and provides assistance for students applying for graduation. Career counseling is available in the department of the student's major.

The office of the dean is located in Centennial Hall room 201. For further information, visit our website at http://www.swt.edu/science

Department of Biology
(Including General Science and Geological Sciences)

Chair and Professor-Rose. Professors-Aron, Baccus, Horne, Huffman, Koehn, Koke, Lemke, Longley, Williamson. Associate Professors-Arsuffi, Barnes, Benjamin, Garcia, Groeger, McLean, Ott, Tarsitano, Upchurch, West. Assistant Professors-Farr, Forstner, Lambert, Lavalli, Westerlund. Lecturers-Grise', Heger, Manning, Prabhakaran, Simpson, Willis.

Biology is the study of living systems and how they function at the molecular and organismal levels. Because the biological sciences have had and will have profound impact on human society in all areas-longevity, environmental quality, ethics of biotechnology-knowledge of the biological sciences is an essential aspect of higher education.

The Biology Department offers the BS and BA in general biology, aquatic biology, botany, physiology, marine biology, microbiology, wildlife biology, and zoology.

Biology majors take a minimum of ten courses that include the core curriculum of Functional Biology, Organismal Biology, Genetics, a diversity course, a physiology course, and Ecology. At the sophomore level and above, a variety of courses in molecular and organismal biology assure a broad education in any of the regions of specialization. Additional required courses in chemistry, mathematics and physics provide a broad scientific background. A minor outside the Biology Department is required. The BS in biology is often the choice for those seeking pre-medical and pre-dental education.

Biologists usually find employment in research or education. Many graduates work with state agencies or the health science/medical centers and biotechnology laboratories. Certification programs are available in microbiology and wildlife management. Interested students should see the chair or the major area advisers. For a complete description of research programs and educational opportunities in the Biology Department, see the Biology Department on-line at http://www.bio.swt.edu/

Major and Minor in Biology

Majors in biology take a minimum of ten courses.

A minor in biology takes a minimum of six courses of which at least three courses are advanced. These courses must include Biology 1430, 1431, and 2450. Two semesters of chemistry are also required.

A grade of at least a C is required in all prerequisite courses.

Minor in Geology

A minor in geology consists of 19 hours, including GEOL 1410, 1420, 2410, plus seven hours chosen from GEOL 3321, 3410, 4121, 4320, and 4330.

Bachelor of Arts
Major in Biology
(Minimum required: 128-136 semester hours)

Notes:
1. A teaching certificate is available with this degree but will require extra hours.
2. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.

Freshman Year	**Hours**
Biology 1430, 1431	8
Chemistry 1141,1341	4
Chemistry 1142, 1342	4
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Philosophy 1305*	3
Physical Fitness (2 courses)*	2
	34

Sophomore Year	**Hours**
Biology 2450, diversity course	8
Communication 1310*	3
English (Literature)*	3
Art, Dance, Music, or Theatre 2313*	3
Mathematics 2321	3
Modern Language 1410, 1420	8
Political Science 2310, 2320*	6
	34

Junior Year	**Hours**
English 3303	3
Biology (see majors & note 2)	12
Minor or Electives-(see note 2)	6-12
Modern Language 2310, 2320	6
Social & Behavioral Science*	3
	30-36

Senior Year	**Hours**
Biology (see majors & note 2)	12
Minor (or advanced elective hours, see note 2)	10-12
Physics 1410, 1420	8
	30-32

Bachelor of Science
Major in Biology
(Minimum required: 128-140 semester hours)

Notes:
1. Recommended minor is chemistry or biochemistry.
2. A teaching certificate is available with this degree but will require extra hours.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.
4. If two years of the same foreign language were taken in high school, then enough additional hours to total the minimum 128 hours required for the degree will fulfill this requirement. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.

*See University College section of this catalog.

Freshman Year	Hours
Biology 1430, 1431	8
Chemistry 1141, 1341	4
Chemistry 1142, 1342	4
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Philosophy 1305*	3
Physical Fitness (2 courses)*	2
	34

Sophomore Year	Hours
Biology 2450, diversity course	8
Chemistry 2141, 2341	4
Chemistry 2142, 2342	4
Communication 1310*	3
English (Literature)*	3
Art, Dance, Music, or Theatre 2313*	3
Mathematics 2321, 2331	6
Political Science 2310, 2320*	6
	37

Junior Year	Hours
English 3303	3
Biology (see majors & note 3)	12
Minor (or advanced elective hours-see note 3)	8
Physics 1410, 1420	8
Social & Behavioral Science *	3
	29-34

Senior Year	Hours
Biology (see majors & note 3)	12
Minor (or advanced elective hours-see note 3)	4-12
Modern Language (see note 4)	8
Electives	3
	27-35

*See the University College section of this catalog.

Biology Majors (without teacher certification)

All programs require six core courses. The core consists of Functional Biology (1430); Organismal Biology (1431); Genetics (2450); one diversity course chosen from Botany (2410), Zoology (2411), or Microbiology (2400); and one physiology course chosen from Cell Physiology (4441), Plant Physiology (3465), or Vertebrate Physiology (3421). General Ecology (Bio 4416) or Plant Ecology (4454) must be chosen as the sixth course. Electives chosen to fulfill major requirements must be approved by a student's major department advisor.

Program-specific requirements:

Aquatic Biology: Core requirements: 1430; 1431; 2450; diversity course 2411; physiology course 3421 or 3465; and 4416 or 4454. Program requirements: 3460 (Aquatic Biology), 4415 (Ichthyology), and 4470 (Limnology), and one advanced Biology elective. Chemistry 3410 (Quantitative Analysis).

Botany: Core requirements: 1430; 1431; 2450; diversity course 2410 (Botany); physiology course 3465; and 4416 (this is a prerequisite for 4454). Program requirements: 3410 (Morphology of Non-Vascular Plants); 3461 (Plant Taxonomy); 4411 (Morphology of Vascular Plants) or 4412 (Plant Anatomy); and 4454 (Plant Ecology).

General Biology: Core requirements: 1430; 1431; 2450; one diversity course chosen from 2410, 2411, or 2400; one physiology course chosen from 3421, 3465, or 4441; and 4416 or 4454. Program requirements: Four advanced Biology electives as approved by major department advisor).

Physiology: Core requirements: 1430; 1431; 2450; diversity course 2411; one physiology course chosen from 3421, 3465, or 4441; and 4416 or 4454. Program requirements: 4450 (Physiological Ecology of Animals); 4442 (Experimental Techniques); one other advanced physiology course chosen from 4441 (Cell Physiology), 3465 (Plant Physiology), or 3421 (Vertebrate Physiology); and one advanced Biology elective. Chemistry 3410 (Quantitative Analysis) is also required.

Marine Biology: Core requirements: 1430; 1431; 2450; diversity course 2411; one physiology course chosen from 3421, 3465, or 4441; and 4416 or 4454. Program requirements: 3410 (Morphology of Non-Vascular Plants); 2410 (Botany, which is a prerequisite for 3410); 3422 (Oceans and Estuaries); and 3470 (Invertebrate Zoology). In addition, nine semester credit hours of marine biology (three courses) are required. Marine biology courses are limited to formal biology courses taken at a marine station approved by the marine advisor prior to registration.

Microbiology: Core requirements: 1430; 1431; 2450; diversity course 2400; physiology course 4441; and 4416 or 4454. Program requirements: one advanced Biology elective; and three courses selected from 3442 (Virology), 4426 (Immunology), 4445 (Pathogenic Microbiology), or 4446 (Microbial Ecology). A minor in Biochemistry or Chemistry is required

Wildlife Biology: Core requirements: 1430; 1431; 2450; diversity course 2411; one physiology course chosen from 3421, 3465, or 4441; ecology course 4416. Program requirements: 3461 (Plant Taxonomy); 4421 (Ornithology); 4422 (Mammology); 4423 (Wildlife Management); 4435 (Techniques in Wildlife Management); and one course chosen from 4420 (Natural History of Vertebrates) or 4425 (Biometry). Additional coursework is required for certification in Wildlife Biology-see the Wildlife Biology advisor.

Zoology: Core requirements: 1430; 1431; 2450; diversity course 2411; one physiology course chosen from 3421, 3465, or 4441; and 4416 or 4454. Program requirements: 3470 (Invertebrate Zoology); one course chosen from 3480 (Histology) or 3490 (Vertebrate Embryology) or 3495 (Comparative Vertebrate Anatomy); 4420 (Natural History of the Vertebrates); and 4465 (General Entomology).

Teacher Certification in Biology

Students seeking certification to teach biology will follow coursework leading to the BS or BA degree, in addition to taking the necessary courses prescribed by the Texas Education Agency. A minor in chemistry is suggested. Initial or additional certification may be acquired after completing the degree and enrollment in a masters program or as a post-graduate. Students interested in certification are strongly encouraged to see an appropriate adviser in the Biology Department.

Courses in Biology (BIO)

NOTE: While 1320 and 1421 may be taken in either sequence, it is strongly recommended that students take 1320 then 1421 in consecutive semesters/sessions. Students wishing to become Biology majors after taking 1320 and/or 1421 must earn a letter grade of A or B in 1320 and/or 1421. Otherwise, 1430 and/or 1431 will be required.

1320 (BIOL 1308) Modern Biology I, Molecules, Cells, and Physiology. (3-0) Provides students with basic scientific and biological principles. Current problems in biology and the ethics of science are presented with perspectives of public policy from a scientific viewpoint. This course, when accompanied by Biology 1421, will fulfill the Natural Science Core Component. May not be credited toward a biology degree.

1421 (BIOL 1409) Modern Biology II, Organisms, Evolution, and Environment. (3-3) This course provides the non-science major the strong and diverse background necessary to understand the structural and functional diversity of organisms, evolution and behavior, and interactions among organisms and their environment. Topics include issues such as the genetic basis of behavior,

overpopulation and extinction, ozone depletion, and conservation biology. This course is not recommended for majors in the natural sciences, including biology.

1430 (BIOL 1406) Functional Biology. (3-3) Provides the science major with a strong foundation in cellular and molecular biology and physiology. Topics include biological chemistry, metabolism, the molecular bases of cellular functions and genetics, the molecular biology of reproduction and development, cell signaling, neurobiology and the special senses, and human physiology and the immune system. Not recommended for non-majors.

1431 (BIOL 1407) Organismal Biology. (3-3) Provides the science major with a strong foundation in organismal biology, Mendelian and population genetics, evolution, and ecology. Topics include taxonomy, patterns of diversity, ecosystems and human biology, behavior, reproductive biology, and comparative physiology. Not recommended for non-majors.

2400 (BIOL 2421) Microbiology. (3-4) Principles of microbiology, morphology, anatomy, physiology and taxonomy of representative groups of non-pathogenic organisms. Laboratory methods stress studies of pure cultures, the use of laboratory apparatus in quantitative determinations and the detection and identification of microbial populations in the environment. Prerequisites: Biology 1430, 1431.

2410 Intermediate General Botany. (3-3) An introduction to the biology of plants and plant-like organisms, emphasizing their role in ecosystem processes, relationships between structure and function, and the evolutionary relationships among the major plant groups. Prerequisites: Biology 1430 and 1431.

2411 Intermediate Zoology. (3-3) Provides biology majors a strong foundation in animal biology at the organismal level. The format will include details of animal form and function as well as concepts relating to classification, phylogeny, evolution, and ecology. Topics will include natural history, biogeography, adaptations to local environments, shared characters, and behavior. All material is presented in an accepted phylogenetic sequence. Prerequisites: Biology 1430 and 1431.

2430 Human Physiology and Anatomy. (3-4) A course on human physiology covering the various organ systems. Principles of molecular biology, cell and tissue structure, anatomy and relationship of structure and function are stressed. Specifically designed for (1) biology majors requiring only a one-semester human physiology course and (2) home economics majors. Prerequisites: Biology 1320 or 1421.

2440 (BIOL 2420) Principles of Microbiology. (3-3) The Basic Principles of microbiology, morphology, physiology, immunology and the relationship of microorganisms to diseases. This course is designed primarily to meet the requirements for students in allied health sciences and other programs requiring only one semester of microbiology. This course may not be credited toward a biology major or minor.

2450 (BIOL 2416) Genetics. (3-3) An introduction to basic principles of Genetics by studies of Mendelian, molecular, quantitative and population genetics. Topics include: classical transmission genetics, and gene mapping, DNA replication and repair, transcription, translation, control of gene expression, genetic engineering techniques, Hardy-Weinberg equilibrium, evolutionary change via natural selection, and genetic drift. Prerequisites: Biology 1430 and 1431; Chemistry 1141, 1341, 1142, and 1342.

3351 General Genetics. (3-0) Basic principles of genetics which relate to the problems of human populations. A course in genetics for non-science majors. May not be credited toward a biology major. Not creditable toward a biology minor if credit is received for Biology 2450. Prerequisites: Biology 1320, 1421; or 1430, 1431.

3406 Economic Botany. (3-3) An introduction to the utilization of plants by humans and their economic and ecological significance. Laboratories will stress plant features beneficial to economic and societal needs. Prerequisite: Biology 2450.

(WI) **3407 Environmental Science. (3-3)** An ecosystem approach to our world is used to show that stability of living systems depends upon balance of nutrients, energy, and populations. An understanding of natural selection is developed and related to adaptations, ecosystem balance, succession, and the position of humans in the biosphere. Laboratories will emphasize ecosystem interactions and coactions. Limited to Minors.

3410 Morphology of Non-Vascular Plants. (3-3) A study of algae, fungi, charophytes, mosses, and liverworts. Lectures and laboratory studies emphasize evolution, comparative morphology and culture techniques. Prerequisites: Biology 2410 and 2450.

(WI) **3421 Vertebrate Physiology. (3-3)** The physiology of vertebrate organs will be explored by study of the systems in which they function. Mammalian systems will be emphasized. The systems studied include the nervous system, the musculoskeletal system, the endocrine system, the cardiovascular system, the respiratory system, the digestive system, the reproductive system and the urinary system. Prerequisites: Biology 2411 and 2450.

(WI) **3422 Oceans and Estuaries. (3-3)** The study of the physical, morphometric and chemical aspects of oceans and estuaries with emphasis on the flow of energy within the marine environment. At least two field trips are taken to visit marine stations and to collect material for analysis on campus. The course is designed specifically for those students with a major in marine biology. Prerequisites: Biology 2411 and 2450.

3430 Mycology. (3-3) A study of the fungal kingdom including slime molds and lichens. Laboratory studies will emphasize taxonomy, morphology and culture techniques. Prerequisites: Biology 2410 or 2400; 2450.

(WI) **3442 Virology. (3-4)** The structure, multiplication and genetics of bacterial, plant, and animal viruses. The role of viruses in human and plant disease. Prerequisites: Biology 2400, and 2450.

(WI) **3460 Aquatic Biology. (3-3)** An introduction to plant and animal life in the fresh water habitats of the local area.. Prerequisites: Biology 2411 and 2450 and one year of Chemistry.

3461 Plant Taxonomy. (3-3) Principles of identification and classification of plants; nomenclature and characteristics of various plant groups with emphasis on the higher plants. Prerequisites: Biology 2410 and 2450.

3465 Plant Physiology. (3-3) Basic principles of plant physiology studied in lecture and laboratory. Prerequisites: Biology 2410 and 2450 or consent of instructor. One semester of organic chemistry is strongly recommended.

3470 Invertebrate Zoology. (3-4) A study of the comparative morphology, evolution, systematics and natural history of invertebrates. Prerequisites: Biology 2411 and 2450.

3480 Histology. (3-4) A study of the structural and functional relationships between cells and tissues in organs. The laboratory includes the study of prepared slides and of microtechnique. This course is designed to meet the needs of pre-professional students. Prerequisites: Biology 2411 and 2450.

3490 Vertebrate Embryology. (3-3) A comparative study of the processes and forms of vertebrate embryonic development with emphasis on the human. The laboratory includes the study of sea urchin, Amphioxus, frog, chick and pig embryos. Prerequisites: Biology 2411 and 2450.

3495 Comparative Vertebrate Anatomy. (3-4) A comparative study of

structural evolution of the vertebrate body. The laboratory work consists of dissection and study of Amphioxus, lamprey, dogfish, Necturus, a reptile, a bird and/or mammal. This course is designed to suit the needs of biology majors and minors and pre-professional students. Prerequisites: Biology 2411 and 2450.

4299 Undergraduate Research. (0-4) Supervised individual research projects in a mentor-student relationship with a biology professor. Available only to biology majors with junior standing and at least a "B" average. May be repeated once for credit. Prerequisite: Biology 2450 and consent of the supervising professor.

4300 Neurobiology. (3-0) This course will give students an overview of neuroscience, particularly the areas of neuroanatomy, neurophysiology, and evolutionary and developmental neurobiology. Prerequisite: Biology 2450.

4301 Evolution. (3-0) Basic genetic principles applied to natural selection, adaptation, populations, speciation and man's future. Consideration is given to the origin of life, nature of chromosomal variation, evolution of genetic systems and certain other selected topics. Prerequisite: Biology 2450.

4305 Nature Study. (3-3) A comprehensive survey of natural events. Includes laboratory and field work emphasizing observation, collection and discovery of relationships. Creditable only for those seeking elementary certification.

4402 Earth Science I. (3-3) The description and interpretation of earth phenomena considered from the standpoint of meteorology and astroscience. Includes field observations, methods of measurement and interpretation of data related to the physical environment and space technology. May not be counted toward a major or minor in biology.

4403 Earth Science II. (3-3) The description and interpretation of earth phenomena considered from the standpoint of geology and oceanography. Includes field observations, methods of sampling and interpretation of data related to the physical environment. May not be counted toward a major or a minor in biology.

4408 Science Processes and Research. (3-3) Students will analyze research design, design research, interpret data, and communicate results. Stress on broad-field structure and integration of major science concepts and science knowledge. Should be taken the semester prior to student teaching.

4410 Field Biology of Plants. (3-3) Ecological relationships and natural history of plants, including historical geology, geography, soils, vegetational regions and surface geology of central Texas. Emphasis is placed on plant-soil-water relationships to develop conservation concepts. Students will make a representative collection of plants. Prerequisites: Biology 2410 and 2450.

4411 Morphology of the Vascular Plants. (3-3) The structure, life-cycles and evolution of fossil and living vascular plants. Emphasis on such topics as the origin of land plants, evolution of the ovule, angiospermy, the flower and fruit. Prerequisites: Biology 2410 and 2450 and one year of Chemistry.

4412 Plant Anatomy. (3-3) The anatomy of vascular plants stressing descriptive, development and comparative aspects of seed plants and the anatomical adaptations of plants to environmental factors. Prerequisites: Biology 2410 and 2450 and one year of Chemistry .

4413 Parasitology. (3-4) The biology and biological significance of the common parasites of man and animals. (S). Prerequisites: Biology 2411 and 2450.

4415 Ichthyology. (3-3) An introduction to the morphology, taxonomy, natural history and evolution of fishes. Field trips will be made to collect specimens and laboratory periods will be devoted to morphological and systematic analysis. Prerequisites: Biology 2411 and 2450.

(WI) **4416 General Ecology. (3-3)** The ecological relationships that exist between

organisms and those relationships that exist between organism and environment. Laboratory sessions will be devoted to literature review and/or specific ecological problems. This course OR Biology 4454 (Plant Ecology) is required of all biology majors. Prerequisites: Biology 2450 and one of Biology 2410, 2411, 2400.

(WI) **4420 Natural History of the Vertebrates. (3-3)** Environmental relationships and natural history of vertebrates. Emphasis is upon taxonomy, speciation and biotic provinces. The laboratory will include field trips for the study and collection of animals in their natural habitats. Students will assemble a representative collection of animals. Prerequisites: Biology 2411 and 2450.

4421 Ornithology. (3-3) Introduction to anatomy, behavior, ecology and identification of birds of Texas. Laboratory will emphasize field studies of birds and their habitat requirements. Prerequisites: Biology 2411 and 2450.

4422 Mammalogy. (3-3) The taxonomy, distribution, ecology, behavior and evolution of mammals with particular emphasis on wild animals of the southwest. Laboratory will emphasize anatomy, identification, preparation of specimens and field exercises in the methods of population analysis. Prerequisites: Biology 2411 and 2450; Biology 4416 is recommended.

(WI) **4423 Wildlife Management. (3-3)** Applications of the principles of ecology and natural history to the management of wildlife habitats and control of wildlife populations. Laboratory will involve demonstrations and practice exercises with wildlife management techniques and instrumentation and field trips to observe wildlife management projects. Prerequisites: Biology 2410, 2411, and 2450. Recommended are Biology 4416 or 4421 or 4422.

4425 Biometry. (3-3) Basic principles of statistical methods as applied to biological problems such as sampling techniques, analysis of data, experimental design and population dynamics. Emphasis will be on practical application. Prerequisites: Biology 2450 and Math 1315.

(WI) **4426 Immunology (3-4)** A study of the immune response, antigen/antibody reactions, major histocompatibility complex, and immunopathology. Prerequisites: Biology 2400 and 2450. One semester organic chemistry recommended.

4434 Herpetology. (3-3) A course treating the origin and evolution of amphibians and reptiles; their reproductive and physiological tactics; taxonomy/systematics; and population biology. Emphasis will be placed on North American species and those groups inhabiting Texas. Prerequisites: Biology 2411 and 2450

4435 Techniques in Wildlife Management. (3-3) The basic methodology of practical wildlife management. This involves techniques in monitoring and data collection related to population dynamics and habitat parameters of wildlife species. Prerequisites: Biology 2411 and 2450.

(WI) **4441 Cellular Physiology. (3-3)** Advanced cellular biology, including membrane physiology, thermodynamics, energy transduction and distribution, and cellular movement in non-muscle and muscle cells. Laboratory includes discussion of current research and exercises in cellular physiology. Prerequisites: Biology 2450 and one semester of Organic Chemistry.

4442 Experimental Techniques. (3-3) Use of methods and instruments applicable to biological investigations, including colorimetry; UV-spectrophotometry; fluorescence; flame and atomic absorption spectrophotometry; paper, gas, gel filtration and ion exchange chromatography; radioactive counting; and electrophoresis. Prerequisite: Biology 2450.

(WI) **4445 Pathogenic Microbiology. (3-4)** Pathogenic bacteria and their relationship to disease, emphasizing identification of selected groups of pathogens, epidemiology and the biological basis for resistance. Prerequisites: Biology 2400 and 2450.

(WI) **4446 Microbial Ecology. (3-4)** This course will illustrate the wide variety of

bacteria in nature, their interactions with other organisms and the environments, and their roles in global cycling of elements such as carbon, nitrogen, and sulfur. The laboratories will feature enrichments for selected groups of microorganisms (sulfate reducers, nitrogen fixers) and analysis of these isolates by microscopy, gas chromatography and radiochemical substrate utilizations. Prerequisites: Biology 2400 and 2450

4450 Physiological Ecology of Animals. (3-3) This course brings together the principal concepts of environmental physiology of animals inhabiting the major ecological realms of the earth (land, air, sea, and fresh water). The biological problems associated with living in the various ecological realms will be discussed, and the biochemical and physiological adaptations of animals to their diverse habitats will be studied. Prerequisite: Biology 2450

(WI) **4454 Plant Ecology. (3-3)** Physiological ecology and community structure and function in the organization of terrestrial plant ecosystems. Quantitative vegetational sampling and the use of field and laboratory physiological equipment are included in the laboratory. This course OR Biology 4416 (General Ecology) is required of all Biology majors. Prerequisites: Biology 2410 and 2450.

4465 General Entomology. (3-3) Principles of morphology, physiology and taxonomy of insects. Laboratory time will be devoted to a taxonomic study of the common orders and families of insects. Prerequisites: Biology 2411 and 2450.

(WI) **4470 Limnology. (3-3)** The physical, chemical, and biological factors affecting productivity in lakes, ponds, and streams. Limnological sampling methods, chemical, and biological analysis of samples and hydrographic surveying are included in the laboratory. Prerequisites: Biology 2450 and one year of chemistry.

4480 Cytology and Microtechnique. (3-3) A study of cellular structure and microscopic technique. The lecture portion of the course presents cytology of all cell types and theoretical aspects of microscopy including light and electron-based technologies. The laboratory portion of the course provides training in standard light and electron microscopy, laser scanning confocal microscopy, and digital microscopy. Prerequisite: Biology 2450.

4481 Internship in Biological Laboratory Technologies. (0-15) The student will participate in the work of a selected biology unit (private, commercial, or governmental). A research paper, reporting the internship experience conducted at the biological unit under the supervision of a faculty member, will be required. This course may be credited toward a biology major with prior approval of the biology department adviser and chair. Prerequisite: Biology 2450.

Courses in General Science (GS)

3310 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of physical, biological, and earth science. Creditable only for elementary or special education degree candidates. Prerequisite: Physics 1310 and 1320 and 1110.

3320 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of physical, biological, and earth science. Creditable only for elementary or special education degree candidates. Prerequisite: Biology 1320 or 1421 or 1430 or 1431.

Courses in Geology (GEOL)

1410 (GEOL 1403) Physical Geology. (3-2) The study of materials making up the earth, the processes that act upon them, and the results of these processes;

the development of tools for the interpretation of earth's history and structure, and the major geologic concepts.

1420 (GEOL 1404) Historical Geology. (3-2) A continuation of physical geology leading to consideration of the geologic history of the earth (with special emphasis on North America), the evolution of life, the continents through geologic time and the principles and procedures used in the interpretation of earth history. Prerequisite: Geology 1410.

2410 Minerology. (3-3) Study of the crystal systems, physical properties, classification, and hand specimen identification of common rock-forming and ore minerals. Corequisite: MATH 2321.

(WI) **3321 Hydrogeology. (3-0)** Study of hydrologic cycle as it relates to the infiltration and movement on the surface and in rocks. Ground-water as a mangeable resource is explored. Prerequisite: Geology 2410 and MATH 2321. Corequisite: MATH 2331.

3410 Sedimentation and Stratigraphy. (3-3) Principles of the weathering, transportation, deposition, and lithification of sediments. Primary structures and textures of sediments are used to determine environments of deposition. The recognition and classification of strata into stratigraphic units. Prerequisite: Geology 2410.

4121 Directed Study. (1-0) Independent study of a particular subject area in geology. Specific topic to be discussed and agreed upon prior to registration. May be repeated once with different emphasis and professor for additional credit. Prerequisite: approval of the instructor.

(WI) **4320 Topics in Field Geology. (1-3)** On-site directed investigations of geology in locations remote from campus. Will be offered at times other than Fall and Spring semesters. May be repeated once with different emphasis and professor for additional credit. Prerequisite: Geology 3410.

4330 Applied Geology. (1-6) Application of practical geologic laboratory and field methods to environmental, engineering, and planning projects. Prerequisite: Geology 3410.

Department of Chemistry and Biochemistry

Chair and Professor-Irvin. Professors-Carrano, Cassidy, Rudzinski, Walter, Yager. Associate Professors-Blanda, Compton, Easter, Lippmann, Assistant Professors-Feakes, Korn, Watkins.

The science of chemistry provides the basic knowledge needed to address many of society's most pressing needs, such as feeding, clothing, and housing the peoples of the world; tapping new sources of energy; improving health and conquering disease; providing renewable substitutes for dwindling resources; strengthening our national security; and monitoring and protecting our environment. Basic research in chemistry will help future generations cope with their evolving needs and unanticipated problems. Chemistry majors gain skills in quantitative thinking and problem solving. Advanced students can work as laboratory instructors for lower division courses or as research assistants in the department's research laboratories. The faculty, facilities, library holdings, and curriculum of the Department of Chemistry and Biochemistry have been approved by the American Chemical Society.

Chemists work in research, production, quality control, technical services, and/or sales. Graduates have an excellent record of job placement in such diverse areas as the petrochemical industry, computer chip manufacturing, aerospace companies, pharmaceutical companies, the food industry, or as teachers in secondary schools. Many also seek advanced degrees or pursue careers in medicine, dentistry, or pharmacy.

For additional information visit our home page at http://www.swt.edu/chemistry/, call 245-2156 or stop by the department office in Chemistry 238.

Recipients of the BS in chemistry are awarded certificates by the American Chemical Society stating that the minimum requirements for professional chemists have been fulfilled. This program is recommended as preparatory training for graduate or industrial work in chemistry.

The BA is a liberal arts degree designed for students who need a background in chemistry in preparation for other careers, i.e., medicine, dentistry, pharmacy, patent law.

A minor in chemistry requires Chemistry 1141 and 1341; 1142 and 1342; 2141 and 2341; 2142 and 2342; 3410; and one advanced course.

A minor in biochemistry can also be obtained and requires Chemistry 1141 and 1341; 1142 and 1342; 2141 and 2341; 2142 and 2342; 4375; 4385; and 4275.

Bachelor of Science
Major in Chemistry
(Minimum required: 128-135 semester hours)

Notes:

1. A major in chemistry consists of Chemistry 1141 and 1341; 1142 and 1342; 2141 and 2341; 2142 and 2342; 3245; 3330; 3340; 3410; 4231; 4241; 4331; 4341 and at least six semester hours to be taken by election from Chemistry 4275, 4299, 4333, 4375 or 4385.
2. Students should consult a departmental adviser before selecting a minor.
3. A teaching certificate is available with this degree but will require additional hours
4. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours

5. If two years of the same foreign language were taken in high school, then enough additional hours to total the minimum 128 hours required for the degree will fulfill this requirement. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.

Freshman Year	**Hours**
Chemistry 1141, 1341.	4
Chemistry 1142, 1342	4
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2363, (or 2417)	3-4
Philosophy 1305*	3
Physical Fitness (2 courses)*	2
Communication 1310*	3
	32-33

Sophomore Year	**Hours**
Chemistry 2141, 2341	4
Chemistry 2142, 2342	4
English 3303	3
English (Literature)*	3
Mathematics 2471, 2472	8
Minor	4
Physics 1430, 2425	8
	34

Junior Year	**Hours**
Chemistry 3245, 3330, 3340, 3410	12
Minor (see note 4)	8
Modern Language (see note 5)	8
Political Science 2310, 2320*	6
	29-34

Senior Year	**Hours**
Art, Dance, Music, or Theatre 2313*	3
Chemistry 4231, 4241, 4331, 4341	10
Chemistry, advanced (see note 4)	6
Minor and Elective (see note 4)	11-12
Social & Behavioral Science*	3
	33-34

Bachelor of Arts
Major in Chemistry
(Minimum required: 128-137 semester hours)

Note:
1. A teaching certificate is available with this degree but will require additional hours.
2. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.

Freshman Year	**Hours**
Chemistry 1141, 1341.	4
Chemistry 1142, 1342	4
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2363 (or 2417)	3-4
Minor	3-4
Philosophy 1305*	3
Physical Fitness (2 courses)*	2
	32-34

Sophomore Year	**Hours**
Chemistry 2141, 2341	4
Chemistry 2142, 2342	4
English 3303	3
English (Literature)*	3
Mathematics 2471, 2472	8
Physics 1410, 1420 (or 1430, 2425)	8
Political Science 2310, 2320*	6
	36

*See University College section of this catalog.

Junior Year	Hours
Art, Dance, Music, or Theatre 2313*	3
Chemistry 3245, 3330, 3340, 3410	12
Minor (see note 2)	6-8
Modern Language 1410, 1420	8
Social & Behavioral Science*	3
	32-34

Senior Year	Hours
Chemistry, advanced (see note 2)	3
Chemistry 4241, 4341	5
Communication 1310*	3
Electives, advanced (or minor as required-see note 2)	7
Minor, advanced (see note 2)	4-9
Modern Language 2310, 2320	6
	28-33

*See the University College section of this catalog.

Chemistry as a Teaching Field

Students seeking certification to teach chemistry will follow coursework leading to the BS or BA degree, in addition to taking the necessary courses prescribed by the Texas Education Agency. Initial or additional certification may be acquired after completing the degree and enrollment in a master's program or as a post-graduate. Students interested in certification are strongly encouraged to see an appropriate adviser in the Chemistry Department.

Courses in Chemistry (CHEM)

1141 (CHEM 1111) General Chemistry Laboratory I. (0-3) First of two laboratory courses in general chemistry for science-related majors. Course introduces the students to the basics of experimental measurements, including density, separation techniques, formula determinations, titrations, thermodynamics, gas laws, and descriptive chemistry. Prerequisite or Corequisite: CHEM 1341 or CHEM 1310.

1142 (CHEM 1112) General Chemistry Laboratory II. (0-3) Second of two laboratory courses in general chemistry. Laboratory techniques are emphasized, and applied to both qualitative and quantitative analysis. Prerequisites: CHEM 1341 and CHEM 1141; Prerequisite or Corequisite: CHEM 1342.

1310 (CHEM 1305) Introductory Chemistry for Non-Science Majors. (3-0) A one-semester principles course for students in non-science related majors which covers not only the major concepts of chemistry (chemical theory, stoichiometry, bonding and elementary thermodynamics) but also the role of chemistry in problems of contemporary society (energy, pollution, water, etc.). Must be followed by Chemistry 1430 for General education credit.

1341 (CHEM 1311) General Chemistry I. (3-0) First of two lecture courses in general chemistry for science-related majors, covering atomic and molecular structure, bonding, states of matter, solutions, and descriptive chemistry. Knowledge of algebra is required. Concurrent registration in CHEM 1141 is recommended. Students will not receive credit for both CHEM 1310 and CHEM 1341.

1342 (CHEM 1312) General Chemistry II. (3-0) Second of two lecture courses in general chemistry for science-related majors, covering equilibrium processes, acid-base chemistry, and kinetics, and electrochemistry. A basic knowledge of algebra is needed. Concurrent enrollment in Chemistry 1132 is recommended. Prerequisite: CHEM 1341.

1430 (CHEM 1407) Chemistry for Non-Science Majors. (3-3) A one semester course which surveys organic and biochemistry and may include petro-

chemistry, nuclear chemistry, synthetic and natural polymers. Prerequisite: CHEM 1310 or 1341.

2130 Laboratory Technique in Organic Chemistry. (0-3) An optional laboratory to accompany Chemistry 2330, covers experimental techniques of preparation, purification, and determination of physical and chemical properties of organic compounds. Prerequisites: CHEM 1142 and CHEM 1342. Corequisite: Chemistry 2330.

2141 (CHEM 2123) Organic Chemistry Laboratory I. (0-3) This laboratory introduces the student to the general techniques of organic chemistry. Prerequisites: CHEM 1342 and CHEM 1142, and Prerequisite or Corequisite: CHEM 2341.

2142 (CHEM 2125) Organic Chemistry Laboratory II. (0-3) This laboratory involves the study of typical organic reactions. Prerequisites: CHEM 2341 and CHEM 2141 with grades of C or better, and Prerequisite or Corequisite: CHEM 2342.

2330 Organic Chemistry. (3-0) A one-semester course which covers nomenclature, structure and reactions of organic compounds. Natural products and synthetic materials of importance to students of nutrition, allied health sciences and agriculture will be emphasized. Prerequisites: CHEM 1142 and CHEM 1342.

2341 (CHEM 2323) Organic Chemistry I. (3-0) This course covers the nomenclature, reactions and reaction mechanisms of the hydrocarbons and the alkyl halides. Prerequisites: CHEM 1341 and CHEM 1141.

2342 (CHEM 2325) Organic Chemistry II. (3-0) This course covers the nomenclature, reactions and reaction mechanisms of the major functional groups. Prerequisite: CHEM 2341 with a grade of C or better, and Prerequisite or Corequisite: CHEM 2141.

2450 Biochemistry. (3-3) A one-semester study of carbohydrates, proteins, lipids, and vitamins which present digestion, absorption, and intermediary metabolism along with an introduction of the function of enzymes and coenzymes in these processes. Course is designed for students majoring in nutrition, allied health sciences, and agriculture. Prerequisites: CHEM 2330 and 2130; or CHEM 2341 and CHEM 2142.

(WI) **3245 Physical Chemistry Laboratory. (1-4)** Experiments illustrating principles and methods of physical chemistry are performed. Written reports on the experiments are prepared. Prerequisites: CHEM 3330 and CHEM 3410.

3330 Physical Chemistry I. (3-0) The course covers principles of thermodynamics and thermochemistry, phase equilibria, electrochemistry and elementary kinetics including rate laws and mechanisms. Prerequisites: CHEM 1142 and CHEM 1342; and MATH 2472 or 2331.

3340 Physical Chemistry II. (3-0) The course covers mechanics, spectroscopy and statistical thermodynamics and other selected topics. Prerequisites: CHEM 3330, Physics 2425 (or 1420), MATH 2472.

3410 Quantitative Analysis. (3-6) Course covers the general theory and practice of typical methods of gravimetric and volumetric analysis, satisfies the quantitative analysis requirements for chemistry majors, minors, pre-medical and pharmacy students. Prerequisites: CHEM 1142 and CHEM 1342.

(WI) **4231 Advanced Laboratory I. (2-4)** An advanced integrated lab illustrating a variety of chemical techniques for the preparation, characterization and analysis of organic and inorganic materials. Prerequisites: CHEM 3410, 3340, 3245, and Prerequisite or Corequisite: CHEM 4331.

(WI) **4241 Advanced Laboratory II. (2-4)** An advanced integrated lab illustrating a variety of chemical techniques for the preparation, characterization and analysis

of inorganic and organic materials. Prerequisites: CHEM 3410, 3340, 3245, and Prerequisite or Corequisite: CHEM 4341.

(WI) **4275 Laboratory Techniques in Biochemistry. (1-6)** Experiments illustrating principles and methods of biochemistry are performed. Emphasis is placed on the use of instrumentation employed in research on animal, microbial and plant tissue. Prerequisite: CHEM 4375, with C or better.

4299 Undergraduate Research. (0-4) This course is available to undergraduate chemistry majors only. It may be repeated but a maximum of four semester hours from this course are applicable toward the Bachelor of Science degree. Prerequisite: Permission of department.

4331 Instrumental Analysis (3-0) The theory and methodology associated with the quantitative analysis of materials, i.e., electronics, spectroscopy, electrochemistry and chromatography are presented. Prerequisite: CHEM 3340.

4333 Spectroscopy. (3-0) The study of various spectrometric techniques in qualitative and structural analysis of chemical substances. Prerequisite: CHEM 2142 and CHEM 2342.

4341 Advanced Inorganic Chemistry (3-0) Chemical bonding, coordination chemistry compounds, acid-base concepts, and other topics are included along with some descriptive chemistry. Prerequisite: CHEM 3340.

4371 Directed Study. (3-0) Independent study on a particular subject area in chemistry. The specific study area, resource material, goals, and achievements will be approved by the instructor. Prerequisites: CHEM 2142 and CHEM 2342; CHEM 3410, and permission of instructor. May be repeated once for additional credit.

4375 Biochemistry. (3-0) A course devoted to a study of the chemistry of carbohydrates, lipids, proteins, enzymes, and nucleo-proteins. A study of enzyme kinetics and thermodynamics of coupled reactions is included. Note: Credit for Chemistry 4275 is not required for credit in Chemistry 4375. Prerequisites: CHEM 2342 with C or better and CHEM 2142.

4385 Metabolism. (3-0) A study of the biodegradation and biosynthesis of carbohydrates, lipids, amino acids, proteins, and nucleic acids. Prerequisites: CHEM 2342 with C or better and 2142.

Department of Computer Science

Chair and Professor-Ali. Professors-Davis, Hwang. Associate Professors-Durrett, McCabe, Ogden, Peng, Sawey. Assistant Professors-Chen, Hall, Hazlewood, Kaikhah, Slomka, Wahl. Lecturers-Koh, Reichenau.

The Department of Computer Science offers courses in computer architecture, compilers, operating systems, UNIX programming, system programming, software engineering, computer graphics, data base design, computer networks, system simulation, distributed systems, automata theory, human factors, real-time computing, managing computer operations, scientific programming, artificial intelligence, and computer science education. The department offers a major and minor in Computer Science with courses leading to the BS or BA degree. Other courses are available for students seeking teacher certification.

Computer Science graduates work in every sector of industry: hardware manufacture; software development; computer applications in the petroleum, aerospace, and chemical industries; and secondary school teaching.

The Applied Software Technology Research Center (ASTRC) at Southwest Texas State University was established specifically to help organizations stay abreast of the theory and application of software technology. The ASTRC has two basic programs: to perform applied research to develop computer science and software engineering technologies and to assist organizations transfer and apply computer science and software technologies.

The Department of Computer Science website is http://www.cs.swt.edu/

For more information about bachelor's degrees, call (512) 245-3409 or visit the department, in the Mathematics and Computer Science Building, Room 560.

Bachelor of Science
Major in Computer Science
(Minimum required: 128-133 semester hours)

Notes:

1. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.
2. Minor fields of study may be chosen from the list of approved minors on page 75. Advanced Computer Science electives are recommended for additional required hours after satisfying the minor requirements. Mathematics is recommended. See note 3.
3. A total of 17 hours in mathematics is required. The mathematics requirements, plus 3 advanced hours of mathematics, constitute a mathematics minor.
4. The student must take two 4-hour laboratory courses in the same science. Biology 1430, 1431; Chemistry 1141 and 1341, 1142 and 1342; Geology 1410, 1420; or Physics 1410, 1420 are recommended.
5. An additional 4 hours of natural science are required in courses normally taken by science majors. None of the twelve hours of natural science coursework can be science courses designed for non-science majors (as designated by SWT).
6. If two years of the same language are taken in high school, then enough hours to total the minimum 128 hours required for the degree will fulfill this requirement. In the absence of such high school language, two semesters of the same modern language must be taken at the college level.
7. The following is only a suggested outline for the semester and year in which a course might be taken.

Freshman Year

First Semester	Hours	Second Semester	Hours
Computer Science 1318	3	Computer Science 2308	3
Communication 1310*	3	English 1320*	3
University Seminar 1100*	1	History 1320*	3
English 1310*	3	Mathematics 2471	4
History 1310*	3	Philosophy 1305*	3
Mathematics 2358	3		16
	16		

Sophomore Year

First Semester	Hours	Second Semester	Hours
Computer Science 3358	3	Computer Science 2318, 3409	7
Mathematics 2472, 3398	7	Modern Language (see note 6 above)	4
Modern Language (see note 6 above)	4	Natural Science (note 4 above)	4
Natural Science (note 4 above)	4	Physical Fitness (one course)*	1
	18		16

Junior Year

First Semester	Hours	Second Semester	Hours
Computer Science 3398	3	Computer Science (advanced)	6
English (Literature)*	3	English (Literature or 3303 or 3313)	3
Math 3305	3	Electives (see note 1 above)	6
Social & Behavioral Science*	3	Computer Science 3339	3
Physical Fitness (one course)*	1		18
Additional Natural Science (see note 5 above)	4		
	17		

Senior Year

First Semester	Hours	Second Semester	Hours
Computer Science advanced	6	Computer Science 4326 or 4398	3
Political Science 2310*	3	Computer Science electives	5
Electives (see note 1 above)	5-9	Art, Dance, Music, or Theatre 2313*	3
	14-18	Political Science 2320*	3
			14

*See the University College section of this catalog.

Bachelor of Arts
Major in Computer Science
(Minimum required: 128 semester hours)

Notes:

1. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.
2. Minor fields of study may be chosen from the list of approved minors on page 75. Advanced Computer Science electives are recommended for additional required hours after satisfying the minor requirements.
3. The student must take two 4-hour laboratory courses in the same science. Biology 1430, 1431; Chemistry 1141 and 1341, 1142 and 1342; Geology 1410, 1420; or Physics 1410, 1420 are recommended.
4. The following is only a suggested outline for the semester and year in which a course might be taken.

Freshman Year

First Semester	Hours	Second Semester	Hours
Computer Science 1318	3	Computer Science 2308	3
Communication 1310*	3	English 1320*	3
University Seminar 1100*	1	History 1320*	3
English 1310*	3	Mathematics 2358	3
History 1310*	3	Philosophy 1305*	3
Mathematics 1315, 1319, or higher	3	Physical Fitness (one course)*	1
	16		16

Sophomore Year

First Semester	Hours	Second Semester	Hours
Computer Science 3358	3	Computer Science 2318, 3409	7
Mathematics 3398	3	Modern Language	4
Modern Language	4	Social & Behavioral Science*	3
Natural Science (note 3 above)	4	Natural Science (note 3 above)	4
Electives/Minor (see notes 1 & 2 above)	3		18
	17		

Junior Year

First Semester	Hours	Second Semester	Hours
Computer Science 3398	3	Computer Science (advanced)	6
English (Literature)*	3	English (Literature or 3303 or 3313)	3
Electives/Minor (see notes 1 and 2 above)	3	Electives/Minor (see notes 1 and 2 above)	3
Physical Fitness (one course)*	1	Modern Language (Sophomore level)	3
Modern Language (Sophomore level)	3		15
Mathematics	3		
	16		

*See the University College section of this catalog.

Senior Year

First Semester	Hours	Second Semester	Hours
Computer Science advanced	6	Computer Science 4326 or 4398	3
Political Science 2310*	3	Computer Science elective	3
Electives/Minor (see notes 1 and 2 above)	6	Art, Dance, Music, or Theatre 2313*	3
		Political Science 2320*	3
		Electives/Minor (see notes 1 and 2 above)	3
	15		15

*See the University College section of this catalog.

Computer Science as a Teaching Field

Students seeking certification to teach Computer Science will follow coursework leading to the BA or BS degree and will take courses prescribed by the Texas Education Agency. Initial or additional certification may be acquired after completing the bachelor's degree, while enrolled in a master's program, or as postgraduate work. Students interested in certification should see the Computer Science education adviser in the Department of Computer Science.

Minor in Computer Science

A minor in Computer Science consists of Computer Science 1318, 2308, 2318, 3358, 3409 and at least six advanced hours in Computer Science. Mathematics 2358 and 3398 are also required.

Courses in Computer Science (CS)

1308 (COSC 1300) Computer Literacy and the Internet. (2-2) A study of the uses of computers and their effects on society. Text processing, spread sheets, databases, the internet as a research tool, and web programming. An introductory course assuming no previous computer or other technical background.

1318 (COSC 1320) Foundations of Computer Science. (3-0) An introductory course for majors and minors in computer science. The structure of the digital computer, data representation, the software process, good coding style, and algorithm development are stressed. The control structures of C++ are emphasized. Prerequisite: A grade of C or better, or concurrent registration in, Math 1315 or higher.

2308 (COSC 2320) C++ and C Programming. (3-0) Programming in C++. The language C is introduced and contrasted with C++. A continuation of CS 1318. Prerequisite: A grade of C or better in CS 1318.

2318 Assembly Language. (3-0) A course covering the organization of digital computers; assembly language programming including addressing, looping, logic, shifting and masking operations, macros, subroutines, co-routines, arithmetic algorithms, and recursion. Prerequisites: A grade of C or better in CS 2308 and Math 2358.

2378 Topics in Computer Science. (3-0) Selected topics in Computer Science. May be repeated with different emphasis for additional credit. Prerequisite: Consent of instructor.

2388 Internet Programming on the World Wide Web. (3-0) An introductory course covering web page construction using HTML and Java Script.

2428 Applications Programming in Visual Basic. (3-1) A self-contained programming course using Visual Basic.

2478 Topics in Computer Science. (3-2) Selected topics in Computer Science. May be repeated with different emphasis for additional credit. Prerequisite: Consent of instructor.

3339 Computer Architecture. (3-0) Use of fundamental hardware components. Topics include ALU's, single and multiple cycle datapath and control, RISC vs. CISC, pipelining, caches, I/O, virtual memory and related performance issues. Prerequisites: A grade of C or better in CS 2318 and CS 3409.

3358 Data Structures. (3-0) A course covering classic data structures and an introduction to object-oriented development. Prerequisites: A grade of C or higher in CS 2308; and a grade of C or higher, or concurrent enrollment, in Math 3398.

3378 Theory of Automata. (3-0) An introduction to automata theory, computability, and formal languages. Prerequisite: A grade of C or better in CS 2318.

3398 Software Engineering. (3-0) The study of software design, implementation, and validation techniques through team projects. Structured analysis, programming style, and project documentation are emphasized in large software projects. Prerequisite: A grade of C or better in CS 3358.

3409 Fundamentals of Computer Technology. (3-2) An introduction to computer hardware and the technologies used to create, capture, and communicate digital information. A laboratory provides hands-on experience with the subject matter, e.g., electricity, combinational and sequential digital circuits, VLSI, etc. Prerequisite: A grade of C or better in Math 2358.

3468 Embedded Computer Systems. (3-2) A study of the architecture of embedded systems, micro-controllers, their peripherals, languages, and operating systems and the special techniques required to use them. Prerequisites: A grade of C or better in CS 2318 and CS 3409.

4100 Computer Science Internship. (1-0) Provides on-the-job training supervised by computer scientists in industry internship programs approved by the computer science department.

4310 Computer Networks. (3-0) A survey of network architectures and their components. Emphasis will be on media access, network and transport layer protocols. Prerequisite: A grade of C or better in CS 3358.

4318 Program Translators. (3-0) A study of computer languages, data structures, algorithms, and theory used in constructing compilers and other program translators. Prerequisite: A grade of C or better in CS 3358.

4326 Human Factors of Computer Systems. (3-0) Principles and methods in human factors and ergonomics applied to the design and use of computer systems. Prerequisite: A grade of C or better in CS 3358.

4328 Operating Systems. (3-0) Principles of operating systems. Algorithms for CPU scheduling, memory management, cooperating sequential processes and device management. Prerequisites: A grade of C or better in CS 2318 and 3358.

4332 Introduction to Database Systems. (3-0) Introduction to database concepts, data models, file structures, query languages, database management systems. Prerequisite: A grade of C or better in CS 3358.

4346 Introduction to Artificial Intelligence. (3-0) An introduction to the basic concepts of artificial intelligence; search techniques, knowledge representation, problem solving. Prerequisite: A grade of C or better in CS 3358.

4350 UNIX Programming. (3-0) Fundamentals of UNIX operating systems, programming tools, programming environments, shells and shell programming. Prerequisite: A grade of C or better in CS 3358.

4364 Real-Time Computing Applications. (3-0) An introduction to the

problems, concepts, and techniques in software systems that must interface with time dependent systems. The course concentrates on application systems by carrying out example projects, but it also covers operating system features necessary to support real-time applications. Prerequisite: A grade of C or better in CS 3358.

4368 Survey of Computer Languages. (3-0) A survey of computer languages. Criteria for choosing languages to be covered include history, important development paradigms and environments, and language implementations. Prerequisite: A grade of C or better in CS 3358.

4378 Topics in Computer Science. (3-0) Selected topics in Computer Science. May be repeated with different emphasis for additional credit. Prerequisite: Consent of instructor.

4378O Object-Oriented Concepts and Programming. (3-0) This course covers object-oriented analysis and design and object-oriented implementation languages, C++ and Java, to present an overview of object-oriented software development. Prerequisite: A grade of C or better in CS 3358.

4378P Introduction to Digital Multimedia. (3-0) Concepts, problems and techniques in digital multimedia. Topics include digital representation of video and data compression. Applications, primarily in education and business presentations, and new and potential capabilities, such as video on demand and virtual reality. Prerequisite: CS 3358.

4388 Computer Graphics. (3-0) A study of the hardware and software used in graphic representation and interpretation of data. Prerequisites: A grade of C or better in CS 3358 and familiarity with trigonometric functions.

4395 Independent Study in Computer Science. (3-0) Open to undergraduate students on an independent basis by arrangement with the faculty member concerned.

4398 Software Engineering Project. (3-0) Students undertake a software development project. They work in teams, writing the requirements and design documents and then the teams produce and test the software. The lectures cover techniques of analysis, design, implementation and testing software. Prerequisite: A grade of C or better in CS 3398.

Department of Mathematics

Chair and Professor-Wayment. Professors-Bandy, Chatfield, Dix, Edgell, Hazlewood, Jia, Kennedy, Northcutt, Passty, Singh, Spellmann, Thickstun, Torrejon, M. Warshauer, Welsh. Associate Professors-Acosta, Curtin, Gu, Jones, Ratliff, Snyder. Assistant Professors-Doerr, T. Keller, Lee, McCabe, Morey, Vasquez. Lecturers-Betros, Davis, Fatehi, Fischer, Gronberg, Hermsmeier, C. Keller, Stein, H. Warshauer, Zielinski.

The study of mathematics is more than four thousand years old and comprises an enormous body of knowledge. Mathematics remains a very active area of research continually giving rise to new theories and questions. The knowledge accumulated and the questions being considered concern both mathematics itself and its many applications.

Mathematics is a fundamental skill required at some minimal level of all educated people, and required in depth in many professions. The teaching objective of our Department includes the development of reasoning and computations skills, and the preparation of students for careers requiring a significant mathematical background.

Students majoring in mathematics may complete the requirements for either the Bachelor of Arts or the Bachelor of Science degree, with or without teaching certification. Any major requires 17 credit hours in core courses and 15 additional credit hours which vary with the student's program. See the degree plans below.

For the BA or BS, a major in mathematics requires at least 32 semester hours, including Mathematics 2471, 2472, 3330, 3380, 4307 and 15 semester hours of advanced mathematics. The fifteen hours must follow one of two plans. The first consists of 3373, 4315, 4330 plus any two of the following courses: 3305, 3323, 3325, 3348, 3375, 3377, 3398, 3428, 4305, 4306, 4336, 4338, 4382. The second is the certification plan and consists of 3305, 3315, 3377, 4304 and 4311. Notice that Mathematics 3315, 4302, 4304 and 4311 are not in the list of elective courses when taking the plan that includes Mathematics 3373. Even though Mathematics 2471 is the first required mathematics course, some students will need to take courses numbered below 2471. Credit examinations in Mathematics 1315, 1317, 2363 and 2417 are available.

A student seeking certification to teach at the secondary level must take Reading 3323, Education 4681 and Curriculum and Instruction 3310, 3325, 4332, 4343. The student who has further questions should see the undergraduate advisor in Mathematics.

The minor in mathematics without teaching certification requires at least 17 hours in mathematics courses. This must include Mathematics 2471, 2472 and at least three courses above the 3000 and below the 5000 level other than 3315, 4302, 4304 and 4311.

Pre-engineering course work should include Mathematics 2472, 2472, 3323, 3373, and 3375. The intent of this work is to strengthen academic background, and to assist students wishing to transfer credit hours to an engineering program at another university. For more information, consult with the pre-engineering advisor in the Department of Mathematics.

The Mathematics department website is http://www.swt.edu.math/

Bachelor of Science
Major in Mathematics
(Minimum required: 128-132 semester hours)

Degree Requirements:

1. At least 32 hours are required in mathematics and must include Mathematics 2471, 2472, 3330, 3380, 4307, and at least 15 semester hours of advanced mathematics. The fifteen hours must follow one of two plans. The first consists of 3373, 4315, 4330 plus any two of the following courses: 3305, 3323, 3325, 3348, 3375, 3377, 3398, 3428, 4305, 4306, 4336, 4338, 4382. The second consists of 3305, 3315, 3377, 4304, and 4311.
2. *General Education Core Curriculum requirements must be satisfied. See the University College section of this catalog.
3. Three hours in a scientific programming language are required in computer science with Computer Science 2488 (or 1318) recommended.
4. **A fourth semester of English is required for this degree (usually 3303).
5. One year of college level modern language is required for all math majors, even those with two or more semesters of the same language in high school.
3. ***A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.

Freshman Year	**Hours**
Communication 1310*	3
Electives	3
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2471	4
Minor	8
Physical Fitness (2 courses)*	2
	33

Sophomore Year	**Hours**
Computer Science (1318 or 2488 recommended	3-4
English (Literature)*	3
English**	3
Mathematics 2472 and 3330	7
Minor	6
Modern Language	6-8
Philosophy 1305*	3
	31-34

Junior Year	**Hours**
Art, Dance, Music, or Theatre 2313*	3
Mathematics 3380 and two advanced Math courses	9
Minor/Electives***	6
Political Science 2310, 2320*	6
Natural Science*	7-8
	31-32

Senior Year	**Hours**
Electives***	18
Mathematics 4307 and three advanced Math courses	12
Social & Behavioral Science*	3
	33

Bachelor of Arts
Major in Mathematics
(Minimum required: 128-133 semester hours)

Degree Requirements:

1. At least 32 hours are required in mathematics and must include Mathematics 2471, 2472, 3330, 3380, 4307, and at least 15 semester hours of advanced mathematics. The fifteen hours must follow one of two plans. The first consists of 3373, 4315, 4330, plus any two of the following courses: 3305, 3323, 3325, 3348, 3375, 3377, 3398, 3428, 4305, 4306, 4336, 4338, 4382. The second consists of 3305, 3315, 3377, 4304, and 43ll.
2. *General Education Core Curriculum requirements must be satisfied. See the University College section of this catalog.
3. Three hours in a scientific programming language are required in computer science with Computer Science 2488 (or Computer Science 1318) recommended.
4. **Students are required to complete 2310 and 2320 in a modern language.
5. ***A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.

Freshman Year	**Hours**
Communication 1310*	3
Electives	3
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2471	4
Physical Fitness (2 courses)*	2
Natural Science*	7-8
	32-33

Sophomore Year	**Hours**
Computer Science (1318 or 2488 recommended)	3-4
English (Literature)	6
Mathematics 2472, 3330	7
Minor	6
Modern Language	8
Philosophy 1305*	3
	33-34

Junior Year	**Hours**
Art, Dance, Music, or Theatre 2313*	3
Mathematics 3380 and two advanced Math courses	9
Minor	9
Modern Language**	6
Political Science 2310, 2320*	6
	33

Senior Year	**Hours**
Electives***	9-11
Mathematics 4307, and three advanced Math courses	12
Minor/Electives***	6
Social Science*	3
	30

Courses in Mathematics (MATH)

1300 Pre-College Algebra. (3-0) A course to remediate and review basic academic skills in mathematics, including number concepts, computation, elementary algebra, geometry and mathematical reasoning. Mathematics 1300 will not constitute a part of the hours required for a bachelor's degree.

1311 Basic Mathematics. (3-0) A preparatory course for college algebra. Topics include linear equations and inequalities, rational expressions, exponents and radicals, quadratics and word problems. This course is designed for students who have graduated from high College with no more than the minimum mathematics requirements or for students who have been away from mathematics for a

number of years. Prerequisite: Mathematics 1300 with a grade of "CR" or Mathematics ACT score of at least 15 (SAT 320 or SAT recentered 400); or a mathematics placement score of at least 14. Mathematics 1311 will not constitute a part of the hours required for a baccalaureate degree.

1315 (MATH 1314) College Algebra. (3-0) A course covering linear and quadratic equations, inequalities, word problems, functions, logarithms, systems of equations and other college algebra topics as time permits. Prerequisite: Mathematics ACT Score of at least 21 (SAT 435 or SAT recentered 480); or a mathematics placement score of at least 26; or Mathematics 1311 with a grade of A, B, C, or CR.

1316 (MATH 1332) A Survey of Contemporary Mathematics. (3-0) A study of the uses of mathematics in society today. Emphasis is on concepts rather than technical details. May not be used as a prerequisite for any other mathematics course. Prerequisite: Mathematics ACT score of at least 21 (SAT 435 or SAT recentered 480); or a mathematics placement score of at least 26; or Mathematics 1311 with a grade of A, B, C or CR.

***1317 (MATH 1316) Plane Trigonometry. (3-0)** A course covering trigonometric functions, right triangles, radian measure, graphs of trigonometric functions, trigonometric identities, including multiple and half-angle identities, inverse trigonometric functions, trigonometric equations, oblique triangles, and complex numbers. A student may receive credit for only two of Mathematics 1317, 2417, and 2363. Prerequisite: A grade of at least C in Mathematics 1315.

1319 (MATH 1324) Mathematics for Business and Economics I. (3-0) Topics from college algebra and finite mathematics which apply to business and economics including applications of equations and inequalities, simple and compound interest and annuities. Prerequisite: Mathematics ACT score of at least 21 (SAT 435 or SAT recentered 480) or a mathematics placement score of at least 26; or Mathematics 1311 with a grade of A, B, C, or CR.

1329 (MATH 1325) Mathematics for Business and Economics II. (3-0) Topics from finite mathematics and elementary differential calculus which apply to business and economics. Prerequisite: A grade of at least C in either Mathematics 1315 or 1319.

2311 (MATH 1335) Principles of Mathematics I. (3-0) Logical deductive reasoning, number theory, a rational development of the real numbers with the associated number structures and algorithms for the fundamental operations, including historical, philosophical and cultural significance. Prerequisite: A grade of at least a C in Mathematics 1315.

2312 Informal Geometry. (3-0) Geometric measuring. Euclidean Geometry, and topics associated with informal geometry, including historical, philosophical, and cultural significance. Prerequisites: A grade of at least a C in Mathematics 2311.

2321 (MATH 2313) Mathematics for Life Sciences I. (3-0) This course is designed to serve the needs of students in the life sciences. Topics will include: graphs, derivatives, exponents and logarithms, scientific notation, sequences, summation, and applications. Prerequisite: An ACT score in Mathematics of at least 24 (SAT 500 or SAT recentered 520) or a grade of at least a C in Mathematics 1315.

2328 (MATH 1342) Non-Mathematical Statistics. (3-0) Non-mathematical introduction to random sampling, mean, variance, statistical inference, testing hypothesis and regression analysis. Prerequisite: A grade of at least a C in Mathematics 1315.

2331 Mathematics for Life Science II. (3-0) Extension of Mathematics 2321. Topics will include: trigonometric functions, probability, integral calculus,

differential equations, and applications. Prerequisite: A grade of at least a C in Mathematics 2321.

2358 (MATH 2305) Discrete Mathematics I. (3-0) A study of discrete mathematical structures that are commonly encountered in computing hardware and software. Prerequisite: A grade of at least a C in Mathematics 1315.

***2363 (MATH 1348) Analytic Geometry. (3-0)** A course covering lines, circles, parabolas, ellipses, hyperbolas, translations, rotations, polar coordinates, and vectors. A student may receive credit for only two of Mathematics 1317, 2417, and 2363. Prerequisite: A grade of at least a C in Mathematics 1317.

***2417 (MATH 2412) Pre-Calculus Mathematics. (3-2)** A survey of functions, trigonometry and analytic geometry to prepare students for calculus. Prerequisite: An ACT score in mathematics of at least 24 (SAT 500 or SAT recentered 520) or a grade of at least a C in Mathematics 1315.

2471 (MATH 2413) Calculus I. (3-2) A first course in differential and integral calculus which stresses limits as well as the applications of calculus to the problems of science. Prerequisite: An ACT score in mathematics of at least 26 (SAT 540 or SAT recentered 560) or a grade of at least a C in either Mathematics 2363 or 2417.

2472 (MATH 2414) Calculus II. (3-2) A continuation of differential and integral calculus including methods of integration, sequences and series, and introduction to partial derivatives. Prerequisite: Mathematics 2471 with a grade of at least C.

3305 Introduction to Probability and Statistics. (3-0) Basic probability models, generating functions and conditional probability, also discrete and continuous, univariate and bivariate distributions of random variables. Concepts of estimation, tests of hypothesis and statistical inference. Prerequisite: A grade of a least a C in Mathematics 2472.

3315 Modern Geometry. (3-0) Modern geometry with emphasis on the triangle, circle, plane and Euclidian geometry, and historical aspects will be integrated into the course. Prerequisites: A grade of at least C in any of MATH 2331, or MATH 2471.

3323 Differential Equations. (3-0) A course covering solutions to the more common types of ordinary differential equations, especially those of first and second order, with emphasis on geometrical and physical interpretations. Prerequisite: Mathematics 2472 with a grade of at least C.

3325 Number Systems. (3-0) Algebraic construction of the natural numbers. Covers the basic vocabulary and proof techniques of abstract algebra, and the structural properties of the natural numbers, integers, rational, real and complex number systems. Prerequisite: Credit or concurrent registration for Mathematics 2471.

3330 Introduction to Topology. (3-0) An introduction to the theory of sets, relations, functions, finite and infinite sets, and other selected topics. Algebraic structure and topological properties of Euclidean Space, and an introduction to metric spaces. Prerequisite: A grade of at least a C in Mathematics 2471.

3348 Deterministic Operations Research. (3-0) This course provides a broad view of deterministic operations research techniques. Topics include dynamic programming, linear and integer programming, deterministic inventory models, and sequencing problems. This course is listed also as Computer Science 3348. Prerequisite: Mathematics 1315 with a grade of at least C.

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*At most, only two Mathematics 1317, 2417, and 2363, may be counted for credit.

3373 Calculus III. (3-0) A course covering sequences and series, vectors, functions of several variables, partial derivatives, multiple integrals, line and surface integrals, and applications. Prerequisite: Mathematics 2472 with a grade of at least C.

3375 Engineering Mechanics. (3-0) A course covering statics, using a vector approach to mechanics. The course is designed to satisfy the requirements of engineering Colleges. Prerequisite: Physics 1430 and credit or concurrent enrollment in Mathematics 2472.

3377 Topics in Linear Algebra. (3-0) An introductory course in linear algebra covering vector spaces, linear transformation, matrices, systems of linear equations, and inner product spaces. Prerequisite: Mathematics 2472 with a grade of at least C.

3380 Advanced Calculus I. (3-0) A course covering the introduction to the theory of real functions. Topics include limits, continuity and derivatives and associated topics. Prerequisite: Mathematics 3330 with a grade of at least C.

3398 Discrete Mathematics II. (3-0) A continuation of discrete Mathematics I. Prerequisite: A grade of at least C in Mathematics 2358.

4302 Principles of Mathematics II. (3-0) Probability, statistics, calculator and computer applications in mathematics, including historical, philosophical and cultural significance. Prerequisite: A grade of at least C in Mathematics 2311.

4304 Math Understandings. (3-0) Basic concepts underlying algebra, geometry, trigonometry, and calculus taught from an advanced standpoint, including historical, philosophical, and cultural significance. Unless specified, this course may not be counted for major or minor credit in mathematics. Must be taken before student teaching. Prerequisites: A grade of at least C in Mathematics 2472 and 3315.

4305 Probability and Statistics. (3-0) A course covering sample spaces, probability of events, binomial and multinomial distributions, random variables, normal approximations, statistical inference, and applications. Prerequisite: Mathematics 3305 with a grade of at least C.

4306 Fourier Series and Boundary Value Problems. (3-0) Advanced solution methods for differential equations; partial differential equations; series approximations, Fourier series; boundary value problems typical of scientific applications. Prerequisite: A grade of at least C in Mathematics 3323.

4307 Modern Algebra. (3-0) A course covering elementary set theory, structures, functions, and concepts of modern algebra. Prerequisite: A grade of at least a C in either Mathematics 3325 or Mathematics 3377.

4311 Introduction to the History of Mathematics. (3-0) A survey of the development of major mathematical topics, including geometry, algebra, calculus, and advanced mathematics. Philosophical and cultural aspects will be integrated with the structure, theorems, and applications of mathematics. Prerequisite: A grade of at least C in Math 3315 and a grade of at least C in either Math 2331 or Math 2472.

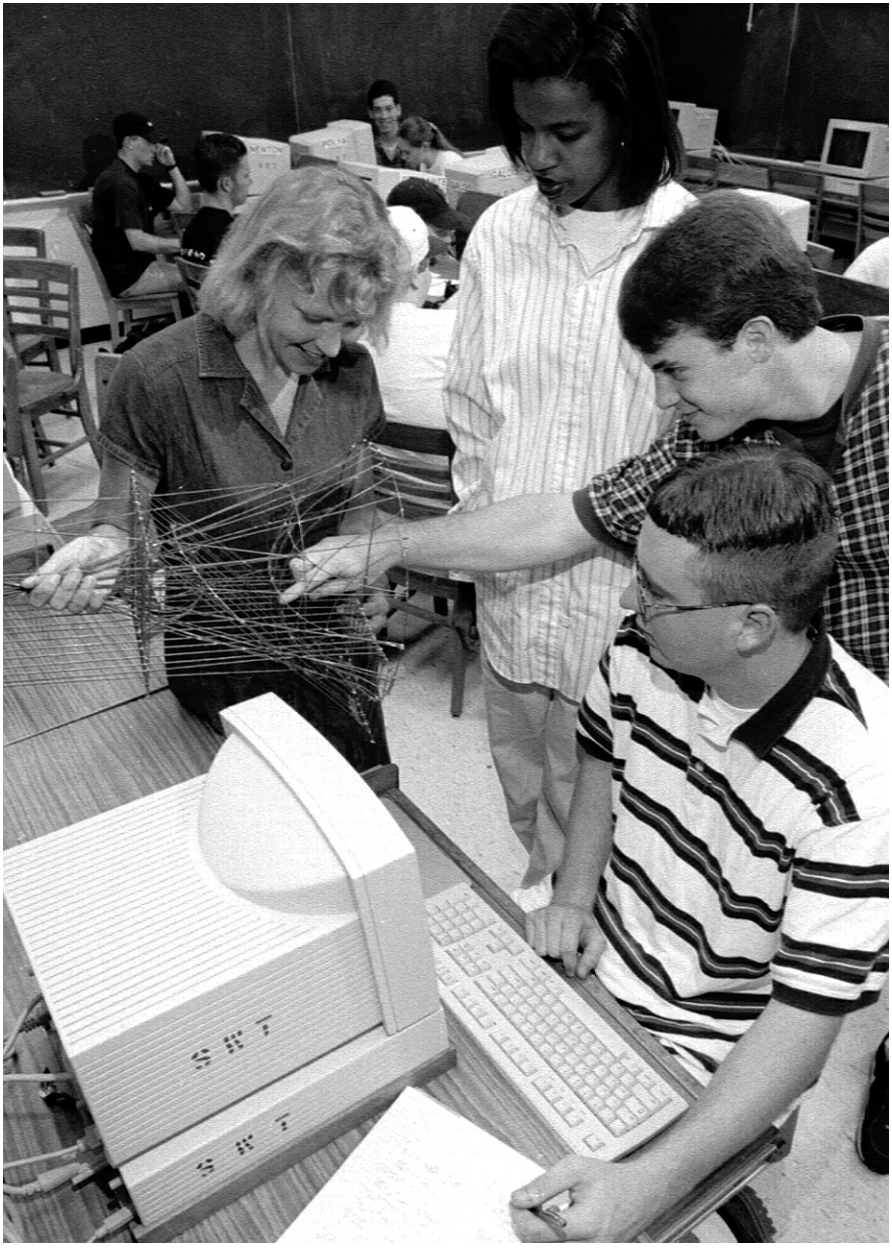
4315 Advanced Calculus II. (3-0) A continuation of Mathematics 3380. Topics include integration, series and sequences of functions and associated topics. Prerequisite: A grade of at least a C in Mathematics 3380.

4330 General Topology. (3-0) Topics include introductory treatment of convergence, continuity, compactness, connectedness and fixed points in topological spaces with special emphasis on metric spaces. Prerequisite: A grade of at least a C in either Mathematics 3330 or 3380.

4336 Topics in Applied Mathematics. (3-0) Selected topics including Laplace transforms, complex variables, advanced calculus for applications, calculus of variations, integral equations, intermediate differential equations, vector

analysis, etc. Prerequisite: Consent of instructor. May be repeated once for credit with a different topic.

(WI) **4382 The Literature and Modern History of Mathematics and Its Applications. (3-0)** This course will focus on mathematical articles in recent journals. The articles will be re-written so that the proofs and comments are more easily understood by the casual reader. This embellishment of journal articles will take place in class with the class participating, in groups for outside work and as individual assignments. Prerequisites: A grade of at least C in two of the three mathematics courses: 3380, 4307, 4330.



Department of Physics

Chair and Professor-Crawford. Professors-Covington, Michalk, Olson. Associate Professor-Gutierrez. Assistant Professors-Galloway, Geerts. Lecturer-Doescher. Mitte Endowed Chair-Stouder (jointly with Technology).

Physics, the study of matter and energy, is at the root of every field of natural science and underlies all physical phenomena. The problem-solving skills learned in the study of physics are valuable even if one's career is not in a physics-related field.

To meet the needs of students interested in physics as a major, the department offers two bachelor's degrees. The BS provides a rigorous background in physics as a preparation for graduate studies or a career in industry. The BA is for students who want a background in physics but plan to pursue fields of interest other than physics as a life's work. Also, a "3-2" program in physics and engineering is available to students preparing to enter an engineering program at a cooperating institution.

Career opportunities for a physics major exist in a wide variety of settings-from teaching in a classroom to basic research in an industrial or government laboratory, as a self-employed consultant, or as a member of a multidisciplinary research team.

The Physics department website is http://www.physics.swt.edu/

For further information, call the department chair.

Minor in Physics

A minor in physics consists of Physics 1430, 2425, 2435, 3312, 3414, and at least six hours of advanced physics.

Proficiency in Mathematics. Students who enter the university needing mathematics at a level below Mathematics 2363 (or 2417) are urged to attend summer session to avoid delay in starting their physics courses.

Bachelor of Science
Major in Physics
(Minimum required: 128-133 semester hours)

Notes:

1. A BS with a major in physics consists of at least 41 semester hours which include Physics 1430, 2425, 2435, 3312, 3320, 3411, 3414, 4310, 4312, 4315 and at least two additional advanced physics courses chosen from (3315, 3316, 3317, 4311, 4340) or courses approved by the department advisor.
2. Students should consult the department advisor or College of Science Advising Center advisor before choosing a minor.
3. *General Education Core Curriculum requirements must be met. See the University College section of the catalog.
4. Teacher certification is available with this degree but will require extra hours.
5. **Biology 1430 and 1431 may be taken instead of Chemistry 1141, 1341, 1142, and 1342 listed in the sophomore year below.
6. ***A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.
7. ****If two years of the same foreign language is taken in high school, then enough additional hours to total the minimum 128 hours required for the degree will fulfill this requirement. In the absence of such high school language, two semesters of college level modern language must be taken.

Freshman Year	Hours
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2417, 2471	8
Physical Fitness (2 courses)*	2
Physics 1430	4
Communication 1310*	3
	30

Sophomore Year	Hours
Chemistry 1141,1341, 1142,1342**	8
Electives/Minor as required***	3
English 3303	3
English (Literature)*	3
Mathematics 2472 and 3373	7
Philosophy 1305*	3
Physics 2425, 2435	8
	35

Junior Year	Hours
Art, Dance, Music, Theatre 2313	3
Electives/Minor as required***	3
Math 3323	3
Modern Language****	8
Physics 3312, 3320, 3411, 3414	14
Political Science 2310, 2320*	6
	37

Senior Year	Hours
Minor/Electives as required***	11-16
Physics Electives	3
Physics 4310, 4312, 4315	9
Social & Behavioral Science*	3
	26-31

Physics as a Teaching Field

Students seeking certification to teach physics will follow coursework leading to the BA or BS degree, in addition to taking the necessary courses prescribed by the Texas Education Agency. Initial or additional certification may be acquired after completing the degree and enrollment in a master's program or as a post-graduate. Students interested in certification are strongly encouraged to see an appropriate adviser in the Physics Department.

Bachelor of Arts
Major in Physics
(Minimum required: 128 semester hours)

Notes:

1. A BA with a major in physics requires 28 hours including Physics 1430, 2425, 2435, 3312, 3411, and 9 additional hours of advanced physics courses (selected from Physics 3315, 3316, 3317, 3320, 3414, 4310, 4311, 4312, 4315, 4330).
2. A minor may be chosen from any field of interest.
3. *General Education Core Curriculum requirements must be met. See University College section of catalog.
4. A teaching certificate is available with this degree but will require additional hours.
5. **A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000. The College of Science requires a minimum of 9 Writing Intensive hours.
6. ***Biology 1430 and 1431 may be taken instead of Chem 1141, 1341, 1142, and 1342 listed in the sophomore year below.

Freshman Year	Hours
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2471	4
Philosophy 1305*	3
Physical Fitness (2 courses)*	2
Physics 1430	3
Communication 1310*	3
	29

Sophomore Year	Hours
Chemistry 1141,1341, 1142,1342***	8
English (Literature)*	3
Mathematics 2472, 3373	7
Physics 2425, 2435	8
Political Science 2310, 2320*	6
	32

Junior Year	Hours
Art, Dance, Music, or Theatre 2313*	3
Electives/Minor, as required**	8
Modern Language	8
Physics 3411, 3312	7
Social & Behavioral Science*	3
English 3303	3
	32

Senior Year	Hours
Electives/Minor, as required**	20
Modern Language	6
Physics (advanced)	9
	35

Courses in Physics (PHYS)

1110 (PHYS 1105) Elementary Physics Laboratory (0-2) This course explores and illustrates some of the basic principles covered in Physics 1310 and 1320. This lab should be taken as you take the second of the two courses, Physics 1310 and 1320.

1140 (PHYS 1111) Introductory Laboratory in Astronomy. (0-2) An introduction to the constellations, the uses of telescopes, and other material relating to the study of stars and planets. This course is designed to be taken with Physics 1340 or 1350 for those students desiring a laboratory course.

NOTE: Physics 1310 and 1320 are designed for the liberal arts student. The order in which they are taken is not important. They are not recommended for pre-engineering students or majors and minors in science. The laboratory experience is recommended with the second course.

1310 (PHYS 1305) Elementary Physics. (3-0) A non-mathematical survey of mechanics, properties of matter, heat and sound. These topics are described in a conceptual way with applications relating to the world around us. The laboratory experience may be obtained in a separate one-hour credit lab (Physics 1110).

1320 (PHYS 1307) Elementary Physics. (3-0) A non-mathematical survey of electricity, magnetism, light, relativity, and atomic and nuclear physics. These topics are described in a conceptual way with applications relating to the world around us. The laboratory experience may be obtained in a separate one-hour credit lab (PHYS 1110).

1340 (PHYS 1311) Astronomy: Solar System. (3-0) A study of the solar system. Topics included are a study of the sun, the planets and their satellites, the comets, and other components of the solar system. Some aspects of telescopes and ancient astronomy will be included also.

1350 (PHYS 1312) Astronomy: Stars and Galaxies. (3-0) A study of the universe beyond the solar system. Topics included are a study of the stars and star clusters, nebulae, galaxies, and an introduction to some aspects of cosmology.

NOTE: Physics 1410 and 1420 are designed for those students whose program requires technical physics, but who are not pre-engineering students or majors or minors in physics.

1410 (PHYS 1401) General Physics I. (3-2) This course is the first of a two semester sequence which is a survey of the basic laws and principles of physics and includes the topics of mechanics and heat. Emphasis is on solutions to physics problems; a knowledge of algebra and basic trigonometry is essential. Prerequisite: Grade of C or better in Mathematics 1315. Mathematics 1317 is recommended.

1420 (PHYS 1402) General Physics II. (3-2) This is the second course in a two semester sequence which is a survey of the basic laws and principles of physics and includes the topics of waves, electricity and magnetism, and light. Prerequisites: Physics 1410 and grade of C or better in Mathematics 1315. Mathematics 1317 is recommended

Physics 1430, 2425, and 2435 are designed for those students majoring or minoring in physics and for pre-engineering students. Prerequisites: Physics 1410 and Mathematics 1317.

1430 (PHYS 2425) Mechanics and Heat. (3-3) This course is the first course of a three semester sequence (including Physics 2425 and 2435). It is designed to cover the basic laws and principles of mechanics and heat through analytic problem-solving. Corequisite: Mathematics 2471. Credit for both Physics 1410 and 1430 cannot be given.

2425 (PHYS 2426) Electricity and Magnetism. (3-3) A study of the field of electricity and magnetism for physics majors and minors. Prerequisite: Physics 1430. Corequisite Mathematics 2472. Credit in both Physics 1420 and 2425 cannot be given.

2435 (PHYS 2427) Waves and Modern Physics (3-3) A study of the fields of wave motion, sound, light and modern physics at a beginning level for physics majors and minors. Prerequisite: Mathematics 2472 and Physics 2425. Co-requisite: Mathematics 3373.

3301 Musical Acoustics. (3-0) A survey of the physics of sound and acoustic measurement. Special emphasis will be placed on sound production, propagation, and perception as applied to music. Prerequisites: Physics 1410 and 1420 or equivalent.

3312 Modern Physics. (3-0) An introduction to the foundations of modern physics, including the following topics: relativistic mechanics, kinetic theory of matter, quantization of charge, light and energy, the atom, wave nature of particles, and the Schroedinger equation. Prerequisites: Physics 2435.

3315 Thermodynamics. (3-0) The fundamental study of thermodynamics and statistical mechanics. Prerequisite: Physics 2435 (or 1420) and Mathematics 3323.

3316 Applied Electronics. (2-6) A laboratory/lecture course introducing electronic test bench methods for the construction, operation and analysis of important DC/AC circuits utilizing resistors, capacitors, diodes, BJTs, FETs, Op Amps and analog/digital ICs. Elementary semiconductor device physics and semiconductor device microfabrication methods will be discussed. Prerequisite: Physics 2435 (or Physics 2425 by permission).

3317 Optics. (3-0) A study of geometrical and physical optics. Prerequisites: Physics 2435.

3320 Introduction to Mathematical Physics. (3-0) An introduction to the mathematical methods of theoretical physics with emphasis on the vectorial-functional approach emphasized in current research literature. Applications will be made to certain fundamental problems of mechanics and electromagnetic field theory. Prerequisite: Mathematics 3373. Co-requisite 3323.

3411 Advanced Physics Laboratory. (2-6) Experiments in modern physics, with emphasis on demonstrating quantum effects and introducing nuclear physics. Corequisite: Physics 3312.

3414 Mechanics (4-0) Fundamentals of classical mechanics focusing on the physical description of the behavior of single and multiple particle systems. Topics include advanced problem-solving strategies for systems with position and velocity-based forces, simple harmonic oscillators, non-interial reference systems, gravitation and central forces, and rigid body motion. Prerequisites: Physics 2435.

4310 Electromagnetic Field Theory I. (3-0) An introduction to the electromagnetic field theory of classical physics for static fields. Topics included will be the electrostatic field, polarization and dielectrics, electrostatic energy, magnetic field of steady currents, magnetostatic energy, and magnetic properties of matter. Prerequisite: Physics 3320, Math 3323, and Math 3373 (or equivalent preparation, with consent of the instructor).

4311 Quantum Physics of Atoms and Solids. (3-0) Elementary quantum and statistical physics will be applied to develop useful descriptions for solid electronic, magnetic, and superconducting materials. There will be a special emphasis on the operational physics of simple semiconductor materials and devices (i.e., the PN junctions). The description of materials in this course is essential to Physics 4340. Prerequisite: Physics 3312.

4312 Quantum Mechanics, Part I. (3-0) An introductory course on quantum mechanics. Topics include concepts and formulation of quantum mechanics. Hamiltonian operator and Schroedinger equation, harmonic oscillator, matrix formulation of quantum mechanics, uncertainty principle, potential barrier problems, and the hydrogen atom. Prerequisites: Mathematics 3323, Physics 3312, 3320 and six additional hours of advanced physics.

4315 Electromagnetic Field Theory II. (3-0) An introduction to the electromagnetic field theory of classical physics for time varying fields. Topics included will be electromagnetic induction, time varying electric and magnetic fields, Maxwell's equations, electromagnetic energy, electromagnetic waves and radiation, and a brief introduction to some specialized topics. Prerequisite: Physics 4310.

***4320 Selected Study in Physics. (3-0)** Topics are chosen in theoretical and experimental areas of current interest in physics with specific topic to be discussed agreed upon prior to registration. Prerequisite: Approval of the instructor.

4321 Independent Study in Physics. (0-9) Topics are chosen in theoretical and/or experimental physics. Specific topic to be discussed and agreed upon prior to registration. Prerequisite: Approval of the instructor.

4340 Materials Physics Laboratory. (0-9) A laboratory based course introducing a broad array of materials synthesis and characterization methods. The specific subjects will be coordinated with topics of current interest in the literature and will be chosen by mutual consent of the student and faculty advisor. Prerequisites: Physics 3411, 4311, and 3316.

4370 Capstone Course. (0-6) Individual research on a topic selected by the student and department chair resulting in a formal paper and seminar.

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*May be repeated once with different emphasis and professor for additional credit.

Department of Technology

Chair and Professor-Habingreither. Professors- Winek. Associate Professors-Batey, DeLeon, Sriraman. Assistant Professors-Borchers. Lecturers-Hager, Hanzel, Reznicek, Rowe, Urbanovsky. Mitte Endowed Chair-Stouder (jointly with Physics Department)

The mission of the Technology Department is to prepare students for technical/professional careers in industry and education. This mission is accomplished through a dedicated faculty offering programs in specialized areas with formal, technical focus. Upon graduation, students are prepared to assume positions of professional responsibility in the areas of manufacturing, construction, visual communications, engineering, computer related fields of all types, electronics, and education. Fourteen well-equipped technical laboratories serve to educate students in the techniques and processes used by contemporary world class industries.

Degrees offered by the Department of Technology include the Bachelor of Science (BS) with a major in Manufacturing Engineering, a Bachelor of Science in Technology (BST) with majors in Industrial Technology, Engineering Technology, and Information Systems Management, and the Bachelor of Applied Arts and Sciences (BAAS) degree.

The BS with a major in Manufacturing Engineering is designed to provide students with the mathematics, science, theoretical background, and applications skills needed to become manufacturing engineers. Manufacturing engineers plan and control manufacturing processes and production operations to optimize the quality and production efficiency of manufacturing systems. The degree has a concentration in general manufacturing or semiconductor/high technology manufacturing.

The BST in Engineering Technology or Industrial Technology provides students with the technical background to work with engineers in planning production processes, developing tooling, establishing quality assurance procedures, developing safety programs, and calculating time standards. The Industrial Technology degree has program majors in construction, manufacturing, visual communications, and general technology. The general technology major, under Industrial Technology, can be customized to meet specific student needs offering opportunities in electronics, industrial safety, education, etc. Students interested in exploring such opportunities should see a Technology Department advisor for more details. The Industrial Technology degree is more aligned with careers in technical management, while the Engineering Technology degree is more technical and engineering oriented.

The BST in Information Systems Management combines the hardware and software aspects of computer technology into one degree. This blend of technical content, complimented with a management competency, allows students to work in a variety of businesses and industrial settings as Information Systems Managers.

The BAAS is an inverted degree plan that is particularly appropriate for students holding a 2-year technical Associates degree. Students can apply up to 66 credit hours from their Associates degree towards the 4-year BAAS. This is a highly customized degree and transfer students should seek assistance from a Department advisor when transferring. Candidates do not have to hold an Associates degree to enter this program.

Also, the Department offers a “technology specialization by transfer” of up to 24 credit hours from a junior/community college, industrial/engineering technology program. These credits may be applied toward the degree requirements of the

Industrial or Engineering Technology degree with approval of a departmental advisor and the Department Chair prior to admission to the program.

For more information call 512/245-2137 or visit the Technology Department, Technology Building 1, Room 101, or our website www.swt/edu/acad_depts/tech_dept/index.html

Bachelor of Science
Major in Manufacturing Engineering
(Minimum required: 136-137 semester hours with General Manufacturing Curriculum)

Notes:

1. General Education Core Curriculum requirements must be met. See University College section of catalog.
2. The College of Science requires a minimum of 9 hours of Writing Intensive courses. This may require additional hours.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000.

Freshman Year

First Semester	Hours	Second Semester	Hours
University Seminar 1100*	1	Physics 1430	4
Chemistry 1141, 1341	4	Technology 1413, 2332	7
English 1310*	3	English 1320*	3
History 1310*	3	History 1320*	3
Technology 1332	3		17
Math 2471	4		
	18		

Sophomore Year

First Semester	Hours	Second Semester	Hours
Math 2472, 3375	7	Technology 3311	3
Communication 1310*	3	Physics 2425	4
Political Science 2310*	3	Math 3323	3
Chemistry 1142, 1342	4	Political Science 2320*	3
	17	Social & Behavioral Sciences*	3
			16

Junior Year

First Semester	Hours	Second Semester	Hours
Technology 3373	3	Art, Dance, Music, Theatre 2313*	3
English Literature*	3	Technology 3316, 3364, 4374	9
Computer Science advanced elective	3-4	Management 3303	3
Philosophy 1305*	3	Physical Fitness (one course)*	1
Math 3305	3		16
Physical Fitness (one course)*	1		
	16-17		

Senior Year

First Semester	Hours	Second Semester	Hours
Manufacturing Processes Elective[1]	3	Manufacturing Processes Elective[1]	3
Technology 3315, 4345, 4363, 4376, 4391	15	Tech 4365, 4395, 4396	9
	18	Management 4330	3
		Manufacturing Systems Management Elective[2]	3
			18

[1]Manufacturing Processes elective to be chosen from: TECH 1330, 2330, 4330, 4367, 4392
[2]Manufacturing Systems Management elective to be chosen from: TECH 4357, 4380, MATH 3348

Bachelor of Science
Major in Manufacturing Engineering
(Minimum required: 136-137 semester hours with Semiconductor Manufacturing Curriculum)

Notes:
1. *General Education Core Curriculum requirements must be met. See University College section of catalog.
2. The College of Science requires a minimum of 9 hours of Writing Intensive courses. This may require additional hours.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000.

Freshman Year

First Semester	Hours	Second Semester	Hours
University Seminar 1100*	1	Physics 1430	4
Chemistry 1141, 1341	4	Technology 1413, 2332	7
English 1310*	3	English 1320*	3
History 1310*	3	History 1320*	3
Technology 1332	3		17
Math 2471	4		
	18		

Sophomore Year

First Semester	Hours	Second Semester	Hours
Math 2472, 3375	7	Technology 3311	3
Communication 1310*	3	Physics 2425	4
Political Science 2310*	3	Math 3323	3
Chemistry 1142, 1342	4	Political Science 2320*	3
	17	Social & Behavioral Sciences*	3
			16

Junior Year

First Semester	Hours
Tech 3373	3
English Literature*	3
Computer Science advanced elective	3-4
Philosophy 1305*	3
Math 3305	3
Physical Fitness (one course)*	1
	16-17

Second Semester	Hours
Technology 3316, 3364 4374, 4392	12
Management 3303	3
Physical Fitness (one course)*	1
	16

Senior Year

First Semester	Hours
Art, Dance, Music, Theatre 2313*	3
Technology 3315, 4345, 4363, 4375, 4376	15
	18

Second Semester	Hours
Semiconductor Manufacturing Elective[1]	3
Tech 4365, 4395, 4396	9
Management 4330	3
Manufacturing Systems Management Elective[2]	3
	18

[1]Semiconductor Manufacturing elective to be chosen from: TECH 4394, PHYS 4320, PHYS 4340
[2]Manufacturing Systems Management elective to be chosen from: TECH 4357, 4380, MATH 3348

Bachelor of Science in Technology
Major in Industrial Technology
(Minimum required: 128-139 semester hours)

Notes:
1. *General Education Core Curriculum requirements must be met. See University College section of catalog.
2. The College of Science requires a minimum of 9 Writing Intensive hours.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000.

Freshman Year	Hours
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Industrial Technology Core	6-9
Mathematics 1315*	3
Philosophy 1305*	3
Speech Communication 1310*	3
	28-31

Sophomore Year	Hours
Chemistry 1141, 1341	4
English Literature*	3
Industrial Technology Core and/ or Major	15
Physics 1410	4
Political Science 2310, 2320*	6
	32

Junior Year	Hours
Art, Dance, Music, or Theatre 2313*	3
Social & Behavioral Sciences*	3
Industrial Technology Core	27-28
Physical Fitness (one course)*	1
	34-35

Senior Year	Hours
Industrial Technology Core	6
Industrial Technology Program Major	27-34
Physical Fitness (one course)*	1
	34-41

Industrial Technology Core

All industrial technology students must take the following courses to fulfill the industrial technology core requirements:

Technology 1310, 1332, 2344, 2370, 3310, 3322, 3364, 4345, 4380, 4390 (repeat for total of six semester hours credit); Management 3303; English 3303.

Industrial Technology Program Majors

All industrial technology students must select one of the following four program majors (39-47 minimum hours):

Industrial Technology-Construction: Technology 1320, 1330, 2360, 3313, 4313, 4357, 4360, 4361, Geography 3310 or 3320 or 3323; Finance 3301 or Management 3340 or 4373; Accounting 2361; Agriculture 3455; Physics 1420; Chemistry 1142, 1342; Math 1317 or 2417.

General Technology: Courses in the general specialization are selected with the assistance and approval of a Department advisor. Industrial bound students may also choose this flexible option as a concentration.

Industrial Technology-Manufacturing: Technology 1330, 2310, 2330, 4330, 4357, 4362, 4373, 4374, 4391; Geography 3303; Management 4330; Physics 1420; Chemistry 1142, 1342; Math 1317 or 2417.

Industrial Technology-Visual Communications: Technology 1450, 2310 or 2366, 2350, 2365 or 3355, 3350, 3365 or 4355, 4310 or 4366, 4357 or 4355; Geography 3303; Management 4330; Physics 1420; Chemistry 1142, 1342; Math 1317 or 2417.

Bachelor of Science in Technology Major in Industrial Technology (Minimum required: 130 semester hours with teaching certification)

Notes:

1. *General Education Core Curriculum requirements must be met. See University College section of catalog.
2. The College of Science requires a minimum of 9 hours of Writing Intensive courses.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000.

Freshman Year	Hours
English 1310, 1320*	6
Philosophy 1305*	3
History 1310, 1320*	6
Mathematics 1315*	3
Technology 1320, 1330, 1413	10
Chemistry 1141, 1341	4
University Seminar 1100*	1
Physical Fitness (one course)*	1
	34

Sophomore Year	Hours
Communications 1310*	3
English Literature*	3
Political Science 2310, 2320*	6
Technology 3322	3
Physics 1410	4
Technology 1310, 1450, 2310, 2330	13
Physical Fitness (one course)*	1
	33

Junior Year	Hours
English 3303	3
Curriculum & Instruction 3310, 3325	6
Management 3303	3
Technology 2344, 2360, 2370, 3310, 3313, 4374	18
	30

Senior Year	Hours
Art, Dance, Music, or Theatre 2313*	3
Social & Behavioral Science*	3
Curriculum & Instruction 4332, 4343	6
Education 4681	6
Reading 3323	3
Technology 4360, 4362, 4380 and 3 adv. TECH hrs (see note 2)	12
	33

Bachelor of Science in Technology
Major in Engineering Technology
(Minimum required: 135 semester hours)

Notes:

1. *General Education Core Curriculum requirements must be met. See University College section of catalog.
2. The College of Science requires a minimum of 9 hours of Writing Intensive courses.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000.

Freshman Year	Hours
Chemistry 1141, 1341	4
Chemistry 1142, 1342	4
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2471, 2472	8
Philosophy 1305*	3
Technology 1332	3
	35

Sophomore Year	Hours
Mathematics 3305 and 3323	6
Physical Fitness (two courses)*	2
Physics 1430, 2425	8
Political Science 2310, 2320*	6
Technology 2344 and 6 hours from Engineering Technology Specialization	9
Speech Communication 1310*	3
	34

Junior Year	Hours
Art, Dance, Music, or Theatre 2313*	3
Social & Behavioral Sciences*	3
English 3303	3
English Literature*	3
Mathematics 3348	3
Physics 3315 or 3317	3
Technology 3311, 3322, 3364, 4345, 4374	15
	33

Senior Year	Hours
Technology 4390 (2 sections)	6
Economics 3313 or 3335	3
Engineering Technology Specialization	18
Management 3303	3
Mathematics 3375	3
	33

Engineering Technology Specializations

All engineering technology majors must complete a minimum of 24 semester hours in one of the following four specializations:

Communications Systems: Technology 2310, 4372, 4373, 4375, and 4399; plus 9 hours selected from the following: Technology 3370, 4380; Computer Science 2308, 2488; Computer Information Systems 2324, 2371, 3370.

Community Systems: Technology 2360, 3313, 4313, 4360, 4361; plus 9 hours selected from the following: Technology 4380, 4399; Accounting 2361; Finance 3301; Management 4336; Geography 3310, 3320, 3321, 4336, 4338, 4350; Psychology 3331; Agriculture 3455; Health Administration 4328; Recreation 2335.

Environmental Systems: Technology 2310, 4362, 4380; Geography 4313, 4338, 4350; plus 6 hours selected from the following: Technology 4330; Geography 3320, 3321; Chemistry 4331.

Plant Production Systems: Technology 2310, 2330, 4330, 4362, 4391; Management 4330; plus 6 hours from the following: Technology 4310, 4357, 4380; Management 4373, 4377; Sociology 3370.

Bachelor of Science
Major in Information Systems Management
(Minimum required: 129 semester hours)

Notes:

1. *General Education Core Curriculum requirements must be met. See University College section of catalog.
2. The College of Science requires a minimum of 9 Writing Intensive hours.
3. A total of 40 advanced hours is required to graduate. An advanced course is one that is numbered above 3000 and below 5000.

Freshman Year	Hours
Physics 1410	4
English 1310, 1320*	6
University Seminar 1100*	1
History 1310, 1320*	6
Mathematics 2471, 2472	8
Technology 1332, 2330, 2370	9
Physical Fitness (2 courses)*	2
	36

Sophomore Year	Hours
Chemistry 1141, 1341	4
Chemistry 1142, 1342	4
Physics 1420	4
Political Science 2310, 2320*	6
Computer Information Systems 1323, 2324	6
Technology 2310, 3322	6
Speech Communication 1310*	3
	33

Junior Year	Hours
Computer Information Systems 2371, 3322 or 3372, 3370	9
Social & Behavioral Sciences*	3
English 3303	3
English Literature*	3
Management 3303	3
Philosophy 1305*	3
Technology 4372, 4373, 4374	9
	33

Senior Year	Hours
Art, Dance, Music, or Theatre 2313*	3
Technology 4390 (2 sections)	6
Computer Information Systems 3374 or 4344	3
Technology 3364, 4345, 4357, 4375, 4399	15
	27

Bachelor of Applied Arts and Sciences
Major in Applied Arts & Sciences
(Minimum required: 128 semester hours)

The Department of Technology offers a Bachelor of Applied Arts and Sciences (BAAS) degree. This inverted degree program (two plus two) is specifically designed for qualified transfer students who wish to pursue a field of interest in technology. This program is especially well suited to those who hold a technical degree from a 2-year institution. More specific information about this degree program may be obtained by contacting the Department Chair.

Minor in Technology

Eighteen hours are required for a minor in Technology. At least nine hours must be advanced. Courses will be determined by conference with a departmental advisor or the Chair of the Department.

Minor in Photography

The minor in photography features the study of photographic periods and styles equipment use and techniques; photographic presentations; and professional careers in photography. The minor consists of 19 hours: TECH 1450 plus five (5) additional courses selected from the following: TECH 2350, 2366, 3350, 3355, 4350, 4355, and 4366.

Driver and Traffic Safety Education

Certification: A student may receive State of Texas Certification in Driver's Education by completing nine semester hours, which include the following courses: Technology 4380, 4383, 4385 (or 4393). Supervising Teacher Certificate must also complete above requirements, plus Technology 5692. For more information on this program contact the Director, Traffic Safety Center.

Courses in Technology (TECH)

1310 Computer Applications in Technology. (2-2) This is an introductory course in Computer Applications as related to technology. The concepts of hardware, software, networking, telecommunications, DOS, Windows, Macintosh, and UNIX will be covered. Students will gain hands-on experience in using software programs in CAD, CNC, and Robotics Programming, statistical quality control, and computerized estimating. Unique input and output devices related to technical applications will be demonstrated.

1320 Furniture Design and Construction. (2-3) Fundamentals of furniture design, styles, human factors, specification writing, shop drawing, and construction techniques are studied. Furniture materials, hardware, finishes, and furniture manufacturing machinery are used. Actual pieces of furniture are designed and built by the student. Prerequisite: TECH 1413 or consent of the instructor.

1330 Assembly Processes. (2-2) Basic assembly process to include gas, arc, resistance, thermite, induction, and forge welding; weld-ability, weld metallurgy, weld symbology, and weld testing; brazing; soldering; mechanical fastening to include threaded fasteners, rivets, shrink and press fits, seams, staples, crimping, and structural adhesives. Principles of joint design and cost estimation. An overview of electronics assembly processes and automated assembly.

1332 Materials and Processes of Industry. (3-0) The variety of materials, processes, and equipment used by industry to change raw materials into industrial materials or finished products including metallics, plastics, earths, and others, processes and equipment used to separate, combine, or form the materials studied.

1413 Engineering Design Graphics. (3-3) An introductory communications course in the tools and techniques utilized to produce various types of working drawings. Principles of multiview projections, geometric relationships, shape and size description, and pictorial methods are included with emphasis on technical applications and design problem solving.

1450 Basic Photography. (3-3) Black and white photography stressing the basic fundamentals of the photographic process; use of modern cameras and accessories; procedures in making pictures from exposed sensitive materials to completed prints; competencies in darkroom procedures.

2310 Machine Drafting. (3-3) Introduction to the use of computer-aided drafting techniques (CAD) and application of basic principles of engineering drawing to the preparation of drawings for manufacturing processes. Emphasis includes principles of descriptive geometry, multiview projection, precision dimensioning, machine tooling, dies, production drawing, machine design and fabrication methods. Prerequisite: Technology 1413 or consent of instructor.

2330 Fundamentals of Material Removal. (3-0) An overview of the micro and macro structure of materials is studied. Assessment of materials with regard to their chemical and mechanical properties and how these properties relate to machining is explored. Machining conditions with regard to feed, speed, surface finish, tooling requirements, horsepower capabilities, time, and cost analysis complete the class. Prerequisite: Math 1315.

2332 Material Selection and Manufacturing Processes. (3-1) This course provides an overview of material processing, material selection and process parameter determination. Processes covered include: material removal, forming, casting, polymer processing, semiconductor manufacturing and assembly processes. Laboratory activities provide opportunities for applying the design through manufacture activities of the product cycle. Prerequisite: Technology 1332.

2344 Power Technology. (2-2) This class deals with understanding the basic laws of thermodynamics. It probes the issues of efficiency and examines energy-converting devices from the inputs, processes, outputs model. Internal combustion engines, electric motors, hydraulic systems, pneumatic systems, wind electric systems, solar energy systems, and gearing systems are reviewed from a practical and a theoretical perspective. Fuel analysis, lubricants, and friction all comprise essential topic areas. Prerequisite: Math 1315.

2350 Exploring Advanced Black and White Darkroom Techniques. (2-4) Experimenting with various darkroom techniques, such as high contrast printing, combination printing, multiple printing, base-relief, solarization, posterization, reticulation, combining black and white with color, in order to enhance their black

and white printing competencies. Prerequisite: Technology 1450 or Journalism 1450.

2360 Building Construction Systems. (2-3) This is an introductory course in building construction systems. Site work, foundations, walls, roofing, ceiling, floor, and finishing systems are studied along with construction materials and an introduction to HVAC, plumbing, and electrical systems.

2365 Introduction to Printing Technology. (3-3) Introduction to major printing processes, materials, equipment, and the preparation of image designs for production using computer graphics.

2366 Electronic Image Manipulation (2-2) This introductory course will utilize basic graphics and photographic manipulation programs to introduce important concepts in computers and computer-based imagemaking. The student will explore the use of computer hardware and image enhancement software.

2370 (ENGR 2305) Electricity/Electronics Fundamentals. (2-2) Fundamentals of safety, Ohm's Law, series, parallel, and series-parallel circuits, meters, relays, and basic transistor circuits.

(WI) **3310 Industrial Design. (3-0)** The fundamentals, elements, and principles of design applied in creative ways to industrial design problems emphasizing function, form, and aesthetics. Ergonomics, product life cycles, environmental concerns, and use of elementary statics for stress analysis.

3311 Mechanics of Materials (3-1) This course covers the principles of mechanic materials and includes the following topics: stress and strain; elastic modulus and Poisson's ratio; constitutive equations; torsion; bending; axial, shear and bending moment diagrams; deflection of beams; and stability of columns. Prerequisite: MATH 1317.

3313 Architectural Drafting. (3-3) Architectural drafting techniques and principles of home planning. Exterior and interior design of the home, essentials of heating, lighting, ventilating, sanitation, and legal aspects of homebuilding; structural systems in wood, concrete, and metal. Complete plans for a one-story residence will be drawn by each student. Prerequisite: Technology 1413 or 2310.

3315 Engineering Economic Analysis. (3-0) Interest formulas, economic equivalence, rate of return analysis, techniques of economic analysis for engineering decisions and an introduction to cost estimation. Prerequisites: Math 1315 and Technology 2332.

3316 Computer Aided Design. (3-1) Applications of modern computer hardware and software systems to the product design and development processes. Topics include: material selection, tolerancing practices, machine elements, geometric modeling, finite element analysis and rapid prototyping. Prerequisites: Technology 1413 and 3311.

(WI) **3322 Development of Technology. (3-0)** The role of technology in the development of Western World culture is studied from a technical perspective. Social repercussions resulting from the introduction of foundational technical developments are reviewed. Examples of technical areas examined are agriculture, transportation, manufacturing, engineering, defense, and communications. Readings focus discussions and papers on specific topics and encourage synthesis level understanding.

3350 Presentation Photography. (3-3) Analysis and application of photography as a means of visual communication; use of professional equipment: 35 mm photographic system, video camera, including still, computers, slide/sync tape player. Students plan, produce, and evaluate 2 x 2 color slide presentations and computer presentations. for visual communication applications.

3355 Criminal Investigative Photography (2-2) Exploratory experiences in

the accepted photographic techniques used by law enforcement agencies to both document and investigate criminal activity and accidents.

3364 Quality Assurance. (3-0) This course covers the principles of quality management to include basic probability and statistics concepts, control charts for attributes and variables, sampling plans, quality audits and costs. The laboratory component of this class includes exercises that provide exposure to basic metrology and data collection.

3365 Graphic Communications Technology. (3-3) Photo-offset fundamentals, layout stripping, plate-making, and multi-color work. Multi-color screen printing and computer graphics. Prerequisite: Technology 2365 or consent of instructor.

3370 Audio Frequency Communications. (2-2) A study of the characteristics of basic electronic circuits and their component parts. Course content includes the use of electronic test equipment, inductance, capacitance, reactance, impedance, rectification, switching, amplification, and electronic circuit fabrication. Prerequisite: Technology 2370.

3373 Circuits and Devices. (3-1) DC and AC circuit analysis, network theorems, electromechanical devices, electronic devices and an introduction to amplifiers, oscillators, and operational amplifiers. Prerequisite: Physics 2425.

4197 Special Topics. (Arrangement) The investigation of a special topic by developing the problem, researching the topic, and presenting the findings as they apply to industry/technology. This course will be applicable to all areas of technology, and must be done only with the approval of the cooperating faculty member and Department Chair.

4297 Special Topics. (Arrangement) The investigation of a special topic by developing the problem, researching the topic, and presenting the findings as they apply to industry/technology. This course will be applicable to all areas of technology, and must be done only with the approval of the cooperating faculty member and Department Chair.

4310 Technical Drafting. (3-3) The application of computer-aided drafting (CAD) using industrial standard software on micro-computers. Technical areas of drafting will be selected from machine tools, industrial products, architectural, cartography, technical illustration, aerospace, topographic, drafting for computer numerical control, structural steel, electrical/electronic, piping, jigs and fixtures, gears and cams, intersection and development, welding, robotic simulations, and other engineering applications. Prerequisites: Technology 1413, 2310 or consent of instructor. Repeatable for credit.

4313 Advanced Architectural Drafting. (3-3) Architectural drafting and light commercial construction; community, urban and regional planning; exterior and interior design of selected light commercial buildings; essentials of heating, lighting, ventilation, sanitation, and legal aspects of commercial buildings; structural systems in wood, concrete, and metal. Complete plans for a light commercial and/or a two story residence will be made by each student. Prerequisite: Technology 3313.

4321 Flight Instruction Academics. (3-0) Provides instruction necessary to pass the Federal Aviation Administration written examination in order to fulfill academic requirements for a private pilot's license. Includes instruction in: Aircraft Pre-Flight; Flight and System Controls; Federal Aviation Agency Regulations; Navigation; Weather; Weight and Balance; Radio Communications; and Airman Information Manual.

4325 Fundamentals of Computer Visualization and Animation. (2-3) An introduction to computer visualization and animation. Visualization will include geometric construction, surface material, surface mapping, surface texture, lighting and camera field of vision. Animation will include industrial animation techniques

such as imploding, morphing, mechanical cycle, and camera paths. The animations will be downloaded to an electronic format.

(WI) **4330 Foundry and Heat Treatment. (3-3)** The technical aspects of foundry and heat treatment of ferrous and non-ferrous metals are reviewed. Students gain proficiency with interpretation of binary phase diagrams, mathematical modeling of gate and runner systems, micro-structural analysis, process cost evaluation, sand testing, investment casting and other technical processes. Technical report writing is an important part of this class. Data collection and data analysis with experiments allow students to develop appropriate techniques for presenting technical data in report format. Technology 1332 recommended.

4345 Methods Engineering and Ergonomics. (3-0) Principles and procedures of methods engineering to include concurrent engineering, charting techniques, motion analysis, principles of motion economy, human factors, direct time study, standard data systems, predetermination time standards and work sampling.

4350 Color Printing. (2-4) The making of color photographic prints. Students will use modern photographic equipment, such as color head enlarger, color analyzers, film processors, and automatic print processors. Prerequisite: Any two of Technology 1450, 2350, or 3350.

4355 Studio Photography. (2-3) Studio photography emphasizes professional photographic techniques through the operation of specialized equipment currently utilized in the field. It includes experiences in posing, exposure and composition used in large format technology. Course may be repeated one time for credit.

4357 Facilities Design. (3-0) Survey and application of the principles and methods used for solving plant layout and material handling problems in industry.

4360 Building Construction Site Organization. (2-3) The course covers the aspects of construction necessary to obtaining a contract and organizing the construction site in order to build a structure. Contracts, insurance, bonding, AIA documents, specifications, plans, and financing are studied. Selected structures are built.

4361 Construction Estimating and Scheduling. (2-3) The professional aspects of construction including estimating, labor, materials, time, detailed take-off methods, and scheduling including Gantt and PERT/CPM techniques. Profit and overhead are covered along with range estimating and depreciation methods. Contemporary computer programs are used.

4362 Manufacturing Processes I. (1-3) This course deals with the application of metal cutting principles learned in 2330. Included in the requirements are steel rule dye layout, machine layout, tool life, tool wear, tool geometry and reconditioning, feed and speed principles, metal removal rates, and power consumption calculations. Machining steel as well as castings produced in the laboratory with various types of cutting tool materials and varying geometry contribute toward the wide variety of experiences included in this basic manufacturing course. Plain indexing activities complement basic machine operations in a unique and most unusual way. Prerequisite: Technology 2330.

4363 Concurrent Process Engineering. (3-2) Emphasis is placed on the integrated design and development of products and processes. Topics covered include: design for manufacture/assembly, quality function deployment, value analysis, group technology and rapid prototyping. Lectures will be complemented by case studies and laboratory projects. Prerequisites: Technology 2332 and 3316.

4365 Tool Design. (3-1) Design of single and multi-point cutting tools, jig and fixture design, gage design, and the design of tooling for polymer processing and sheet metal fabrication. Laboratory projects will involve the use of computer aided design and rapid prototyping. Prerequisites: Technology 2332 and 3316.

4366 Electronic Publishing. (2-2) Students will create black and white, grayscale, color digital files of artwork and photographs using various electronic imaging equipment. These imaging files will be imported into various image manipulation programs to produce digital halftones and color separations. The resulting images will be graphically reproduced on a variety of print production.

4367 Polymer Properties and Processing. (3-1) Structure, physical & mechanical properties, design considerations and processing methods for polymer-based materials are presented. Processing methods include: injection molding, blow molding, thermoforming, compression molding, extrusion, filament winding, lay-up methods, vacuum bag molding and poltrusion. Prerequisite: Technology 2332.

4372 Electronic Instrumentation. (2-2) Transistor configurations, field effect transistors and circuits, voltage regulation, amplifier feedback principles, operational amplifiers and circuitry, and unijunction transistors and applications. Prerequisite: Technology 2370.

4373 Industrial Electronics. (2-2) A study of control systems, electrical switching, electrical generation, motors, wiring, illumination, and temperature controls as they apply to industry. Electronic product development and manufacturing are studied through classroom and laboratory activities. Prerequisite: Technology 2370.

4374 Digital Electronics (2-2) Solid state digital electronics from basic concepts to current industrial needs in terms of logic gates (all types), number systems counters (all types), registers (all types), sequential control circuits, and shift register generator. Prerequisite: Technology 2370 or Physics 2425.

4375 Computer Circuit Electronics. (2-2) Computer circuits as they are related to digital electronics, digital computer circuits, microprocessor, and memory concepts. Prerequisites: Technology 2370 and 4374.

4376 Control Systems and Instrumentation. (3-0) The theory of automated control systems and its applications to manufacturing systems are covered in this course. Topics covered include: modeling of systems, time and frequency domain feedback control systems, stability analysis, transducer and sensor technology and digital control. Prerequisites: Math 3323, Physics 1430 and Technology 2332.

(WI) **4380 Industrial Safety. (3-0)** Introduction to the field of industrial safety with emphasis on compliance with Federal and State regulations.

4383 Driver and Traffic Safety Education I. (3-0) Content, methods, and materials for instruction in the classroom phase of driver education in Texas. Topics include Texas traffic law; Texas Education Agency standards for high school driver education; driver behavior, attitude, and psychomotor skills; and safety in the highway transportation system.

4385 Driver and Traffic Safety Education II. (3-3) Content, methods and materials for instruction in the laboratory phase of driver education in Texas. Topics include in-car instruction, multi-car range, and simulation. During laboratory sessions participants will observe in-car instructors, peer teach in the car, and teach a high school student how to drive. Prerequisite: Technology 4383 and a good driving record. TECH 4383 and 4385 will be taken simultaneously.

4387 Motorcycle Safety and Rider Education. (3-3) Techniques and methods of teaching beginner rider education. Includes classroom techniques as well as laboratory experience in on-street and off-street riding. Not applicable to the Bachelor of Science in Technology degree program.

(WI) **4390 Internship. (0-3)** Supervised on-the-job experience in a business/industrial/technical area. This course may be repeated for credit with approval of the Department Chair and/or advisor. See Department Chair or advisor for prerequisites.

4391 Manufacturing Processes II. (1-3) This course deals primarily with a wide variety of advanced manufacturing techniques. Included in its structure are the following areas: differential indexing, electrical discharge machining, precision grinding, specialized thread cutting, high energy rate forming, tool grinding, tool behavior analysis, tool cost evaluation, and numerical control programming. An emphasis may be placed on certain processes mentioned above in order to meet the specific needs of various classes. Prerequisites: Technology 2330, 4362, Math 1315.

4392 Microelectronics Manufacturing (3-0) This course will provide an overview of integrated circuit fabrication to include: crystal growth, wafer preparation, epitaxial growth, oxidation, diffusion, ion-implantation, thin file deposition, lithography, etching, device and circuit formation, packaging and testing. The laboratory component will involve actual production and testing of a functional semiconductor device.

4393 Driver and Traffic Safety Education III. (3-3) Content, procedures, and administration of multi-phase driver education programs. Topics include scheduling, maintenance and operation of laboratory equipment, record keeping, lesson plan development, and driver education for the handicapped. Practicum in classroom and/or simulation instruction., Not applicable to the Bachelor of Science in Technology degree program. Prerequisites: Technology 4383, 4385.

4394 Microelectronics Manufacturing II. (3-0) This is an intermediate level course in integrated circuit processing. Topics covered include: atomic models for diffusion, oxidation and ion implantation; topics related to thin film processes such as chemical vapor deposition, physical vapor deposition; planarization by chemical-mechanical polishing and rapid thermal processing; and process integration for bipolar and MOS device fabrication. Students will design processes and model them using a simulation tool such as SUPREM.

4395 Computer Integrated Manufacturing. (3-1) An overview of computer integrated manufacturing from both metals and semiconductor manufacturing perspectives is presented. Topics include: control strategies for manufacturing systems, automated materials handling systems, production planning, shop floor control, manufacturing execution systems, manufacturing databases and their integration, data communication and protocols and man/machine interfaces. Prerequisite: Technology 4375 or 4391.

4396 Manufacturing Systems Design. (3-1) Applications of simulation modeling to the design and analysis of manufacturing systems are presented in this course. Key topics covered include queuing theory and discrete event simulation methods. Design projects will involve the use of current simulation language for modeling and analysis of manufacturing systems. Prerequisites: Math 3305 and Technology 2332.

4397 Special Topics. (Arrangement) The investigation of a special topic by developing the problem, researching the topic, and presenting the findings as they apply to industry/technology. This course will be applicable to all areas of technology, and must be done only with the approval of the cooperating faculty member and Department Chair.

4399 Seminar in Technology. (3-0) The topics for this course will vary. The course will involve the identification of the topic, its nomenclature, its processes, tools, equipment or materials, and its application to technology. The topic may apply to either the certification program or technology program or to both. A final report summary or presentation will conclude each seminar.