COLLEGE OF SCIENCE

Dean's Office:
Phone: (512) 245-2119 Office: Centennial Hall 201
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Advising Center:
Phone: (512) 245-1315 Office: Centennial Hall 202
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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 and Biochemistry, Computer Science, Engineering and Technology Mathematics, and Physics. Five departments offer both the Bachelor of Arts (BA) and Bachelor of Science (BS) degrees. The Department of Engineering and Technology offers a Bachelor of Science in Technology (BST) degree in addition to the BS degree. Majors include applied mathematics, aquatic biology, biochemistry, botany, chemistry, computer science, engineering technology, general biology, general physiology, industrial engineering, industrial technology, manufacturing engineering, mathematics, microbiology, physics, wildlife biology, and zoology. In addition, pre-professional programs of study are available in architecture, dentistry, medicine, engineering, and pharmacy. Secondary teacher certification may be incorporated into some of the majors. Coursework in the geological sciences is available through the Department of Biology.

Academic Advising Center

The College of Science Academic Advising Center provides current students with advising on academic and administrative issues. Students are informed about matters related to academic general education core requirements, scholarships and awards within the College, the selection of an appropriate major and minor, the selection of appropriate courses, transfer and correspondence courses, academic probation/suspension, the choice of an educational program leading to a bachelor's degree, and participation in pre-professional programs. The Advising 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.

Science Teacher Certification

Currently, there are six Texas Grades 8-12 science certifications: Computer Science, Life Sciences, Mathematics, Physical Sciences, Science, and Technology. Students seeking any of these certifications need to follow coursework leading to a degree in the appropriate science field, in addition to taking the required certification courses prescribed below. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student.

Students interested in certification are strongly encouraged to see the Science Advisor early in their undergraduate program or certification process.

The Life Sciences, Physical Sciences, and Science certification programs cannot be completed while enrolled as an undergraduate science student because they exceed the state mandated 139 hour maximum for an undergraduate degree with teacher certification. Students must return after completing the undergraduate science degree as post-baccalaureates to complete the certification courses. Students in these programs should also contact the college academic or science teacher certification advisor regarding their undergraduate degree and certification requirements.

Students seeking **Computer Science** certification will follow the coursework leading to the BS or BA degree in Computer Science in addition to the courses listed below. The required courses are: CS 1428, 2308, 2318, 3358, 12 hours of CS electives, of which 9 hours must be advanced; along with the 21 hour Education block: CI 3310, 3325, 4332, 4343; RDG 3323; and ED 4681.

Students seeking **Life Sciences** certification will follow the coursework leading to the BS or BA degree in Biology in addition to the certification courses listed below. A minor in chemistry is strongly suggested. Required courses are: CHEM 1341, 1141, 1342, 1142; BIO 1430, 1431, 2450, 4408, 4416 or 4454, 2410 or 3406, 8 advanced BIO hours chosen with the approval of the science teacher certification advisor; along with the 21 hour Education block, CI 3310, 3325, 4332, 4343; RDG 3323; and ED 4681.

Students seeking **Mathematics** certification will follow the second option of coursework leading to the BS or BA degree in Mathematics (see the Department of Mathematics section of this catalog) in addition to the certification courses listed below. Required courses are: MATH 3305, 3315, 3377, 4304, and 4311; along with the 21 hour Education block, CI 3310, 3325, 4332, 4343; RDG 3323; and ED 4681.

Students seeking **Physical Science** certification with a baccalaureate degree will follow coursework leading to the BA in Physics with a minor in Chemistry in addition to the courses listed below. Required courses are PHYS 1430, 2425, 2435, 3312, and 6 advanced PHYS hours approved by the science teacher certification advisor; CHEM 1141, 1341, 1142, 1342, 2141, 2341, 2142, 2342, 3410, 4375; BIO 4408 or 5408; along with the 21 hour Education block, CI 3310, 3325, 4332, 4343; RDG 3323; and ED 4681.

Students seeking **Science** certification will follow coursework leading to the BS or BA in Biology, Chemistry, or Physics in addition to the certification courses listed below. Required courses are: BIO 1430, 1431, 2450, 2410 or 3406, 4416 or 4454, 4408 or 5408, 4402, 4403 or GEOL 1410; CHEM 1341, 1141, 1142, 2341, 2141, 2342, 2142, 4375, and 3410; PHYS 1430, 2425, 2435, 3312, and 6 advanced PHYS hours approved by the science teacher certification advisor; along with the 21 hour Education block, CI 3310, 3325, 4332, 4343; RDG 3323; and ED 4681.

Students seeking **Technology** certification will follow the coursework leading to the BST degree in Industrial Technology with teacher certification. See the Department of Technology section for degree audit.

Department of Biology

Phone: (512) 245-2178 Office: Science Building 380
Fax: (512) 245-8713 Web: http://www.bio.txstate.edu/

Degree Programs Offered

- BA, major in Biology
- BS, major in Biology
- BA, major in Biology – Aquatic Biology
- BS, major in Biology – Aquatic Biology
- BA, major in Biology – Botany
- BS, major in Biology – Botany
- BA, major in Biology – General Physiology
- BS, major in Biology – General Physiology
- BA, major in Biology – Microbiology
- BS, major in Biology – Microbiology
- BA, major in Biology – Wildlife Biology
- BS, major in Biology – Wildlife Biology
- BA, major in Biology – Zoology
- BS, major in Biology – Zoology

Minors Offered

- Biology
- Geology

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.

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.

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.

Majors Offered

All programs require six core courses, consisting of BIO 1430, 1431, and 2450; one diversity course chosen from BIO 2410, 2411, or 2400; one physiology course chosen from BIO 4441, 3465, or 3421; and BIO 4416 or 4454. Electives chosen to fulfill the major requirements must be approved by a student's major department advisor. Within the major, students must complete at least 6 advanced Biology courses of which some may be electives.

Biology: Core requirements: BIO 1430, 1431, and 2450; one diversity course chosen from BIO 2410, 2411, or 2400; one physiology course chosen from BIO 3421, 3465, or 4441; and BIO 4416 or 4454. Program requirements: Four advanced BIO electives with a minimum of 15 advanced hours as approved by department advisor.

Biology-Aquatic Biology: Core requirements: BIO 1430, 1431, and 2450; diversity course BIO 2411; physiology course BIO 3421 or 3465; and BIO 4416 or 4454. Program requirements: BIO 3460, 4415, 4470, one advanced BIO elective, and CHEM 3410.

Biology-Botany: Core requirements: BIO 1430, 1431, and 2450; diversity course BIO 2410; physiology course BIO 3465; and BIO 4416. Program requirements: BIO 3410, 3461, 4411 or 4412, and 4454.

Biology-General Physiology: Core requirements: BIO 1430, 1431, and 2450; diversity course BIO 2411; one physiology course chosen from BIO 3421, 3465, or 4441; and BIO 4416 or 4454. Program requirements: BIO 4450, 4442; one other advanced physiology course chosen from BIO 4441, 3465, or 3421; one advanced BIO elective; and CHEM 3410.

Biology-Microbiology: Core requirements: BIO 1430, 1431, and 2450; diversity course 2400; physiology course 4441 or 4447; and 4416 or 4454. Program requirements: three courses selected from BIO 3442, 4426, 4445, 4446, or 4447 and one advanced BIO elective. BIO 4447 can be used to satisfy the physiology requirement or the advanced microbiology course requirement, but not both. A minor in Biochemistry or Chemistry is required.

Biology-Wildlife Biology: Core requirements: BIO 1430, 1431, 2450; diversity course BIO 2411; one physiology course chosen from BIO 3421, 3465, or 4441; ecology course BIO 4416. Program requirements: BIO 3461, 4421, 4422, 4423, 4435, and one course chosen from BIO 4420 or 4425. Additional coursework is required for certification in Wildlife Biology-see the Wildlife Biology advisor.

Biology-Zoology: Core requirements: BIO 1430, 1431, 2450; diversity course BIO 2411; one physiology course chosen from BIO 3421, 3465, or 4441; and BIO 4416 or 4454. Program requirements: BIO 3470; one course chosen from BIO 3480 or 3490; BIO 4420 and 4465.

Bachelor of Arts
Major in Biology

Minimum required: 128-136 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	**Hours**
BIO 1430, 1431	8
CHEM 1141,1341	4
CHEM 1142, 1342	4
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
PHIL 1305	3
PFW two courses	2
Total	**34**

Sophomore Year	**Hours**
BIO 2450, diversity course	8
COMM 1310	3
ENG Literature (see general requirements 2)	3
ART, DAN, MU, or TH 2313	3
MATH 2321	3
Modern Language 1410, 1420	8
POSI 2310, 2320	6
Total	**34**

Junior Year	**Hours**
ENG 3303	3
BIO (see majors offered)	12
Minor or advanced electives (see general requirements 1)	6-12
Modern Language 2310, 2320	6
Social Science component (see general requirements 2)	3
Total	**30-36**

Senior Year	**Hours**
BIO (see majors offered)	12
Minor or advanced electives (see general requirements 1)	10-12
PHYS 1410, 1420	8
Total	**30-32**

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

General Requirements:
1. Recommended minor is chemistry or biochemistry.
2. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
3. 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.
4. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	**Hours**
BIO 1430, 1431	8
CHEM 1141, 1341	4
CHEM 1142, 1342	4
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
PHIL 1305	3
PFW two courses	2
Total	**34**

Sophomore Year	**Hours**
BIO 2450, diversity BIO course	8
CHEM 2141, 2341	4
CHEM 2142, 2342	4
COMM 1310	3
ENG Literature (see general requirements 4)	3
ART, DAN, MU, or TH 2313	3
MATH 2321, 2331	6
POSI 2310, 2320	6
Total	**37**

Junior Year	**Hours**
ENG 3303	3
BIO (see majors offered)	6-12
Minor or advanced electives (see general requirements 2)	8
PHYS 1410, 1420	8
Social Science component (see general requirements 4)	3
Total	**28-34**

Senior Year	**Hours**
BIO (see majors offered)	12
Minor or advanced electives (see general requirements 2)	14-20
Electives	3
Total	**29-35**

Teacher Certification

Currently, there are six Texas Grades 8-12 science certifications: Computer Science, Life Sciences, Mathematics, Physical Sciences, Science, and Technology. Students seeking any of these certifications need to follow coursework leading to a degree in the appropriate science field, in addition to taking the required certification courses prescribed in the College of Science section. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student. Students interested in certification are strongly encouraged to see the Science Advisor early in their undergraduate program or certification process.

Minor in Biology

A minor in biology includes: BIO 1430, 1431, 2450, and 9 advanced BIO hours, not to include BIO 4304, 4402, 4403, or 4408. CHEM 1341, 1141 and 1342, 1142 are prerequisites for BIO 2450. A grade of “C” or higher is required in all prerequisite courses.

Minor in Geology

A minor in geology requires 19 hours, including GEOL 1410, 1420, 2410, and seven hours chosen from GEOL 3410, 3430, 3440, 4121, 4320, 4330, or 4421.

Courses in Biology (BIO)

While they may be taken in either sequence, it is strongly recommended that students take BIO 1320 then 1421 in consecutive semesters/sessions. BIO 1320 and 1421 will not meet the requirements for medical or dental schools.

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 BIO 1421, will fulfill the Natural Science Core Component. This course is not recommended for majors in the natural sciences, including biology.

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. (3-3) 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: BIO 1430, 1431, and CHEM 1341 with a grade of "C" or higher.

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: BIO 1430 and 1431 with a grade of "C" or higher.

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: BIO 1430 and 1431 with a grade of "C" or higher.

2430 (BIOL 2404) 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. May not be credited toward a Biology major or minor.

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: BIO 1430, 1431; CHEM 1141, 1341, 1142, and 1342 with grades of "C" or higher.

(WI) **3308 Global Ecology.** (3-0) An interdisciplinary introduction to the science of global environmental change. Emphasis will be placed on understanding principles of earth system science, the scientific basis underlying the major components of global environmental change, the linkages between these components, and the central role of humanity in contributing to the observed changes. Prerequisites: BIO 1430, 1431 with a grade of "C" or higher.

3300 Cell and Molecular Biology. (3-0) Fundamentals of structure and function of prokaryotic and eukaryotic cells. Course includes cell and organelle structure, basic biochemistry, principles of thermodynamics and energy transformation, nucleic acid and protein synthesis, enzyme kinetics, cell motility and cell signaling. Prerequisites: BIO 1430 and CHEM 1342 with grades of "C" or higher, or permission of instructor.

3351 Forensic and Human Genetics. (3-0) An introduction to basic principles of Mendelian, molecular, and forensic genetics as it relates to the problems of human populations. This course is intended for non-science majors. May not be credited towards a biology major or minor. Prerequisites: BIO 1320 and 1421 or BIO 1430 and 1431.

(WI) **3370 The Biology of Marine Mammals.** (3-0) This course will examine the evolution, behavior, and physiological adaptations (morphological, sensory, energetic, reproductive, and communicative) of the major groups of marine mammals: cetaceans, pinnipeds, and siennas. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.

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: BIO 2450 with a grade of "C" or higher.

3410 Phycology. (3-3) A study of algal organisms, comparative and culture techniques. Prerequisites: 8 hours from BIO 1410, 2410, 2450, 3400, 3450 with a grade of "C" or higher.

(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: BIO 2411 and 2450 with a grade of "C" or higher.

(WI) **3422 Biological Oceanography.** (3-3) This course examines chemical and physical aspects of oceans and estuaries as they relate to biological oceanography, specifically primary and secondary productivity, energy flow, and adaptations of marine organisms. Two field trips are taken to the Gulf Coast of Texas. Prerequisites: BIO 2450, 2410 or 2411 with a grade of "C" or higher; GEO 3335.

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: BIO 2410 or 2400, 2450 with a grade of "C" or higher.

(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: BIO 2400, 2450 with a grade of "C" or higher.

(WI) **3460 Aquatic Biology.** (3-3) An introduction to plant and animal life in the fresh water habitats of the local area. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher; 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: BIO 2410, 2450 with a grade of "C" or higher.

3465 Plant Physiology. (3-3) Basic principles of plant physiology studied in lecture and laboratory. Prerequisites: BIO 2450 with a grade of "C" or higher 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: BIO 2411, 2450 with a grade of "C" or higher.

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: BIO 2411, 2450 with a grade of "C" or higher.

3490 Principles of Developmental Biology. (3-3) This course will cover basic principles of developmental biology in both plant and animal systems. Course will mainly address cell, molecular and genetic mechanisms underlying the development of model organisms. Prerequisites: BIO 1430 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. Prerequisites: BIO 2450 with a grade of "C" or higher 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: BIO 2450 with a grade of "C" or higher.

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: BIO 2450 with a grade of "C" or higher.

4304 Wildlife and Recreation: Impact and Management. (3-0) Students will be introduced to the impact human recreational activities have on wildlife habitats and populations. Management practices to enhance human-wildlife encounters or to minimize detrimental effects on wildlife populations will be presented. Prerequisite: BIO 2450 with a grade of "C" or higher.

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. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

4306 Population Genetics. (3-0) Examines the fundamental mathematical models used by population geneticists and the theory underlying them, emphasizing modern genetic approaches. Prerequisite: BIO 2450 with a grade of "C" or higher.

4350 Special Topics in Biology. (3-0) Selected advanced topics in biology. May be repeated for credit. Prerequisites will be determined by topic and faculty offering the course.

4350A Cellular Physiology of Cancer. (3-0)

4350B Biological Implications of Water Planning in Texas. (3-0)

4369 Biosystematics. (3-0) Biological systematics is a multidisciplinary component of most biological disciplines. Course topics include: classification schemes, homology, homoplasy, the application of nomenclature, and phylogeny reconstruction. The course will also present relevant issues in conservation, biodiversity cataloguing, museum and collection management, and identification methods/dichotomous keys. Prerequisite: BIO 2450 with a grade of "C" or higher.

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. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

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. Required for those seeking grade 4-8 Science and Mathematics/Science certification.

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. Required for those seeking 8-12 Life Sciences and Science teacher certification. May not count as one of the four upper-level Biology courses required of general Biology majors, or one of the three upper-level Biology courses required of Biology minors.

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. Prerequisite: BIO 2450 with a grade of "C" or higher.

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: BIO 2450 with a grade of "C" or higher; 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: BIO 2450 with a grade of "C" or higher; one year of Chemistry.

4413 Parasitology. (3-4) The biology and biological significance of the common parasites of man and animals. Prerequisites: BIO 2411, 2450 with a grade of "C" or higher.

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: BIO 2411, 2450 with a grade of "C" or higher.

(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 BIO 4454 is required of all biology majors. Prerequisites: BIO 2450; BIO 2410, 2411, or 2400 with a grade of "C" or higher.

(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: BIO 2411, 2450 with a grade of "C" or higher.

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: BIO 2411, 2450 with a grade of "C" or higher.

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: BIO 2411, 2450 with a grade of "C" or higher. BIO 4416 is also 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: BIO

2410, 2411, and 2450 with a grade of "C" or higher. BIO 4416, 4421, or 4422 is also recommended.

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: BIO 2450 with a grade of "C" or higher; MATH 1315.

(WI) **4426 Immunology.** (3-4) A study of the immune response, antigen/antibody reactions, major histocompatibility complex, and immunopathology. Prerequisites: BIO 2400, 2450 with a grade of "C" or higher. One semester of organic chemistry is 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: BIO 2411, 2450 with a grade of "C" or higher.

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: BIO 2411, 2450 with a grade of "C" or higher.

(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: BIO 2450 with a grade of "C" or higher; 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: BIO 2450 with a grade of "C" or higher.

(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: BIO 2400, 2450 with a grade of "C" or higher.

(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: BIO 2400, 2450 with a grade of "C" or higher.

(WI) **4447 Microbial Physiology and Genetics.** (3-3) This course will cover fundamental concepts in bacterial physiology and genetics, including central and specialized metabolism, and unique aspects of bacterial genetics. Prerequisites: BIO 2400, 2450; CHEM 2142, 2342 with a grade of "C" or higher

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: BIO 2450 with a grade of "C" or higher.

(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 BIO 4416 is required of all Biology majors. Prerequisite: BIO 2450 with a grade of "C" or higher.

(WI) **4464 Vertebrate Morphology.** (3-3) This course examines the biological processes that promote and maintain diversity. Lectures and laboratory exercises will explore the morphology, classification, and life history of vertebrates. Prerequisites: BIO 1430, 1431, and 2450 with a grade of "C" or higher.

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: BIO 2411, 2450 with a grade of "C" or higher.

(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: BIO 2450 with a grade of "C" or higher; one year of chemistry.

(WI) **4472 Animal Behavior.** (3-3) This course presents all the major facets of the study of animal behavior, giving special attention to its evolution and ecological significance. We will discuss major conceptual models guiding past and present research in the field. Laboratories will emphasize experimental techniques and statistical analysis. Prerequisites: BIO 2450; BIO 2400, 2410, or 2411 with a grade of "C" or higher.

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: BIO 2450 with a grade of "C" or higher.

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: BIO 2450 with a grade of "C" or higher.

Courses in General Science (GS)

3310 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of chemistry and earth space science. Non-creditable for science majors. A required course for Elementary EC-4 Generalist certification, grades 4-8 Science certification, and grades 4-8 Mathematics/Science certification. Prerequisites: PHYS 1310, 1320, and 1110 or PHYS 1410, 1420 completed with a grade of "C" or higher.

3320 General Science. (3-2) A laboratory course designed to acquaint the student with the fundamentals of biological science. Non-creditable for science majors. A required course for Elementary EC-4 Generalist certification, grades 4-8 Science certification, grades 4-8 Mathematics/Science certification. Prerequisite: BIO 1320, 1421, 1430, or 1431 completed with a grade of "C" or higher.

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: GEOL 1410.

2410 Mineralogy. (3-3) Study of the crystal systems, physical properties, classification, and hand specimen identification of common rock-forming and ore minerals. One semester of Chemistry recommended. Prerequisites: GEOL 1410, 1420.

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: GEOL 2410 completed with a grade of “C” or higher.

3430 Structural Geology. (3-3) Description, classification, and origin of earth structures and the stresses involved in their formation. Solution of structural geology problems using analytical geometry, geologic maps, contouring of data, and preparation of cross sections. Prerequisites: GEOL 1410 and 1420 (or equivalents).

3440 Paleontology and Biostratigraphy. (3-3) Identification of ancient invertebrate faunas and their applications in reconstruction of paleoenvironments, paleogeography, and the means by which "time" correlations can be effected in sedimentary strata. Field intensive course, 1 full day in the field per week. Course will be offered alternating summers. Prerequisites: GEOL 1410 and 1420 (or equivalents).

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) **4330 Applied Geology. (1-6)** Application of practical geologic laboratory and field methods to environmental, engineering, and planning projects. Prerequisites: GEOL 1410 and 1420.

(WI) **4421 Hydrogeology.** (3-3) This course will provide the student with an introduction to the science of hydrogeology, a conceptual and quantitative understanding of groundwater from a geological/ mathematical/ geochemical perspective, and experience with hydrogeology applications. Prerequisites: GEOL 1420 (or equivalent) and a minimum of 3 hours of college-level chemistry.

Department of Chemistry and Biochemistry

Phone: (512) 245-2156 Office: Chemistry Building 238
Fax: (512) 245-2374 Web: http://www.txstate.edu/chemistry/

Degree Programs Offered

- BA, major in Chemistry
- BS, major in Chemistry
- BS, major in Biochemistry

Minors Offered

- Chemistry
- Biochemistry

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 and biochemistry 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 chemistry curriculum of the Department of Chemistry and Biochemistry have been accredited by the American Chemical Society.

Chemists and biochemists 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.

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 in Chemistry 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.

The BS in Biochemistry is a degree program that prepares students for careers or advanced study in the biochemical sciences. The program is laboratory intensive and provides students instruction in the modern techniques of biochemistry and molecular genetics.

Bachelor of Arts
Major in Chemistry

Minimum required: 128-136 semester hours

General Requirements:

1. A teaching certificate is available with this degree but will require additional hours.
2. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
3. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	Hours
CHEM 1141, 1341	4
CHEM 1142, 1342	4
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
MATH 2417	4
Minor	3
PHIL 1305	3
PFW two courses	2
Total	**33**

Sophomore Year	Hours
CHEM 2141, 2341	4
CHEM 2142, 2342	4
ENG 3303	3
ENG Literature (see general requirements 3)	3
MATH 2471, 2472	8
PHYS 1410, 1420 or 1430, 2425	8
POSI 2310, 2320	6
Total	**36**

Junior Year	Hours
ART, DAN, MU, or TH 2313	3
CHEM 3245, 3330, 3340, 3410	12
Minor (see general requirements 2)	6-8
Modern Language 1410, 1420	8
Social Science Component (see general requirements 3)	3
Total	**32-34**

Senior Year	Hours
CHEM advanced elective (see general requirements 2)	3
CHEM 4241, 4341	5
COMM 1310	3
Electives or advanced electives	7
Minor, advanced (see general requirements 2)	3-9
Modern Language 2310, 2320	6
Total	**27-33**

Bachelor of Science
Major in Chemistry

Minimum required: 128 semester hours

General Requirements:

1. A major in chemistry consists of CHEM 1141, 1341, 1142, 1342, 2141, 2341, 2142, 2342, 3245, 3330, 3340, 3410, 4231, 4241, 4331, 4341, 4375, and at least three semester hours of upper-level CHEM electives.
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 minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
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.
6. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	Hours
CHEM 1141, 1341	4
CHEM 1142, 1342	4
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
MATH 2417	4
PHIL 1305	3
PFW two courses	2
COMM 1310	3
Total	**33**

Sophomore Year	Hours
CHEM 2141, 2341.	4
CHEM 2142, 2342	4
ENG 3303	3
ENG Literature (see general requirements 6)	3
MATH 2471, 2472	8
Minor	4
PHYS 1430, 2425	8
Total	**34**

Junior Year	Hours	Senior Year	Hours
CHEM 3245, 3330, 3340, 3410	12	ART, DAN, MU, or TH 2313	3
Minor (see general requirements 4)	12	CHEM 4231, 4241, 4331, 4341, 4375	13
POSI 2310, 2320	6	CHEM advanced elective	3
		Minor and Electives (see general requirements 4)	9
		Social Science Component (see general requirements 6)	3
Total	**30**	**Total**	**31**

Bachelor of Science
Major in Biochemistry

Minimum required: 128 semester hours

General Information:

1. Recommended minor is biology.
2. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
3. 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.
4. Two semesters of CHEM 4299 is highly recommended.
5. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	Hours	Sophomore Year	Hours
CHEM 1141, 1341	4	CHEM 2141, 2341	4
CHEM 1142, 1342	4	CHEM 2142, 2342	4
ENG 1310, 1320	6	ENG 3303	3
US 1100	1	ENG Literature (see general requirements 5)	3
HIST 1310, 1320	6	MATH 2471, 2472	8
BIO 1430, 1431	8	BIO 2450	4
PFW two courses	2	PHYS 1430, 2425	8
COMM 1310	3		
Total	**34**	**Total**	**34**

Junior Year	Hours	Senior Year	Hours
CHEM 3375, 3330, 3275, 3380	11	ART, MU, DAN or TH 2313	3
BIO 2400	4	CHEM 4360, 4481, 4482, 4385	14
Minor	6	Minor and advanced electives (see general requirements 2)	10
PHIL 1305	3	Social Science component (see general requirements 5)	3
POSI 2310, 2320	6		
Total	**30**	**Total**	**30**

Teacher Certification

Currently, there are six Texas Grades 8-12 science certifications: Computer Science, Life Sciences, Mathematics, Physical Sciences, Science, and Technology. Students seeking any of these certifications need to follow coursework leading to a degree in the appropriate science field, in addition to taking the required certification courses prescribed in the College of Science section. Initial or additional certification may also be acquired as a post-baccalaureate or graduate student. Students interested in certification are strongly encouraged to see the Science Advisor early in their undergraduate program or certification process.

Minor in Chemistry

A minor in chemistry requires CHEM 1141 and 1341, 1142 and 1342, 2141 and 2341, 2142 and 2342, 3410, and one advanced course with a minimum of 3 advanced hours, not to include CHEM 4299.

Minor in Biochemistry

A minor in biochemistry can also be obtained and requires CHEM 1141 and 1341, 1142 and 1342, 2141 and 2341, 2142 and 2342, 3275, 3375, and 4360 or 4385.

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 Co-requisite: 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, 1141. Prerequisite or Co-requisite: CHEM 1342 with a grade of “C” or higher.

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 CHEM 1430 for general education credit.

1341 (CHEM 1311) General Chemistry I. (3-0) Initial lecture course in general chemistry for science-related majors, covering atomic and molecular structure, bonding, states of matter, solutions, and descriptive chemistry. Concurrent registration in CHEM 1141 is recommended. Prerequisite: Mathematics ACT score of at least 24 (SAT 500 or SAT re-centered 520) or MATH 1315 with a grade of "C" or higher.

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 CHEM 1132 is recommended. Prerequisite: CHEM 1341 with a grade of “C” or higher.

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 CHEM 2330, covers experimental techniques of preparation, purification, and determination of physical and chemical properties of organic compounds. Prerequisites: CHEM 1342/1142. Co-requisite: CHEM 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, 1142 with a grade of “C” or higher. Prerequisite or Co-requisite: 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 higher. Prerequisite or Co-requisite: CHEM 2342.

2150 Biochemistry & Metabolism Lab. (0-3) An optional laboratory to accompany CHEM 2350. This laboratory examines the physical properties and chemistry of carbohydrates, amino acids, proteins, lipids and nucleotides. Course is designed for students majoring in nutrition, clinical laboratory science and agriculture. Prerequisites: CHEM 2330/2330 or 2342/2142. Co-requisite: CHEM 2350.

2330 Fundamentals of Organic Chemistry. (3-0) A one-semester course which covers nomenclature, structure and reactions of organic compounds with an introduction to bioorganic molecules. Course is designed for students majoring in nutrition, clinical laboratory sciences and agriculture. Prerequisites: CHEM 1342/1142.

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 1342/1142 with a grade of "C" or higher.

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 higher. Prerequisite or Co-requisite: CHEM 2141.

2350 Biochemistry & Metabolism. (3-0) A one-semester study of carbohydrate, proteins, lipids and nucleotides which presents both structure and intermediary metabolism along with an introduction to the function of enzymes and coenzymes. Course is designed for students majoring in nutrition, clinical laboratory science and agriculture. Prerequisites: CHEM 2330/2130 or CHEM 2342/2142.

2390 Environmental Chemistry. (3-0) Environmental chemistry examines sources, reactions, transport and fate of chemical entities in the environment, as well as their effects on human health and the natural environment. This multidisciplinary subject draws from such fields as geology, physics, toxicology, limnology, water-treatment and chemistry. Prerequisites: CHEM 1341/1141, 1342/1142.

(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, 3410.

(WI) **3275 Biochemical Techniques. (1-4)** Course introduces students to the fundamental techniques used in modern biochemistry. Experiments use the essential techniques employed in the study of proteins, enzymes and nucleic acids with emphasis on the use of modern instruments and the manipulation and analysis of experimental data. Prerequisite: CHEM 3375 with a grade of "C" or higher.

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 1342/1142 and MATH 2472 with grades of "C" or higher.

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

3350 Physical Chemistry for Biochemists. (3-0) A study of the fundamental theories and laws of physical chemistry as it relates to biochemistry. The topics to be covered include ideal and real gases, classical thermodynamics, reaction kinetics, phase equilibria, electrochemistry, quantum mechanics, spectroscopy and statistical mechanics. Prerequisite or Co-requisite: CHEM 3375.

3375 Principles of Biochemistry. (3-0) This course provides biochemistry majors and minors with a strong foundation in the principles of biochemistry. Topics include the chemical function and structure of proteins, nucleic acids, lipids and carbohydrates; enzyme structure, mechanism and kinetics; and the essential mechanisms used to control enzyme activity. Prerequisite: CHEM 2342 with a grade of "C" or higher.

3380 Physical Methods in Biochemistry. (3-0) This course is designed to acquaint the student with the chemical and physical principles of modern biochemical methods. Emphasis is placed upon the application of the methods to current problems in biochemistry and molecular biology and the interpretation of data. Prerequisite: CHEM 3375 with a grade of "C" or higher.

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 1342/1142.

(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 3245, 3340, 3410. Prerequisite or Co-requisite: 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 3245, 3340, 3410. Prerequisite or Co-requisite: CHEM 4341.

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. Prerequisites: CHEM 2142/2342.

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.

4350 Modern Molecular Modeling. (3-0) A study of the application of computational techniques to molecular modeling. Topics covered include quantum mechanical modeling, forcefield based molecular modeling, molecular energy minimization, molecular dynamics, vibrational spectra, solution of crystalline structures, diffraction patterns, molecular blends, phase equilibria, crystal morphology, physical property prediction and mesoscale modeling. Prerequisite: CHEM 3340.

4351 Introduction to Polymers. (3-0) This course is designed to develop the student's general understanding of polymer history and importance as well as terminology, structure, and synthesis. The overall scope of the course will be to develop the student's general knowledge of polymer synthesis and structure. Prerequisite: CHEM 2342.

4360 Advanced Biochemistry and Molecular Biology. (3-0) This course provides Biochemistry majors and minors with advanced knowledge of the field of molecular biochemistry. Topics include gene expression (transcription and translation of genes in bacteria and higher organisms), post-translational modification of proteins, chromosomal DNA replication, cell cycle checkpoint controls, DNA damage and repair, as well as theories of cancer and aging. Prerequisite: CHEM 3375.

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. May be repeated once for additional credit. Prerequisites: CHEM 2142/2342, 3410, and permission of instructor.

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. Prerequisites: CHEM 2342 with a grade of "C" or higher, 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 a grade of "C" or higher, 2142.

4390 Supramolecular Chemistry. (3-0) This course is designed to be a survey of the nature of non-covalent interactions between host and guest species. Emphasis will be focused on the rational design of hosts, themodynamic and kinetic parameters involved in binding and the applications of various binding/recognition phenomena. Prerequisites: CHEM 3275 with a grade of "C" or higher; CHEM 3380.

(WI) **4481 Advanced Biochemistry Lab I. (2-8)** The first of two laboratory courses providing instruction in the modern techniques of biochemistry. Experiments are performed on the isolation, manipulation and characterization of DNA, RNA and proteins. Students will prepare formal written reports and oral presentations. Prerequisites: CHEM 3275 with a grade of "C" or higher; CHEM 3380.

(WI) **4482 Advanced Biochemistry Lab II. (2-8)** The second of two laboratory courses providing instruction in the modern techniques of biochemistry. Experiments are performed on the isolation, manipulation and characterization of DNA, RNA, and proteins. Students will use their results and the scientific literature to prepare formal written reports and oral presentations. Prerequisite: CHEM 4481.

Department of Computer Science

Phone: (512) 245-3409 Office: Nueces Building, Room 247
Fax: (512) 245-8750 Web: http://www.cs.txstate.edu/

Degree Programs Offered

- BA, major in Computer Science
- BS, major in Computer Science

Minor Offered

- Computer Science

The Department of Computer Science offers courses in computer architecture, computer ethics, compilers, operating systems, Unix system programming, object-oriented design and implementation, web programming with database applications, software engineering, computer graphics, data base design, computer networks application, distributed systems, automata theory, human factors, artificial intelligence, and several programming languages including C, C++, Java Assembly, LISP, HTML, Perl, PHP, and JavaScript. Descriptions of the topics courses listed on these departmental pages are available on the department's Web page, http://www.cs.txstate.edu/courses/undergrad_courses.shtml

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. In addition, for persons who already hold a baccalaureate degree, the department offers a Certificate in Computer Science. Please refer to the Texas State graduate catalog.

The Bachelor of Science degree program in Computer Science is accredited by the Computing Accreditation Commission of the Accreditation Board for Engineering and Technology.

Mission Statement

The mission of the Department of Computer Science is to advance the knowledge of computer science and technology through teaching, research, and service to produce computer scientists and computer literate individuals for the betterment of industry, government, and society.

Computer Science Goals

1. Graduates with degrees in Computer Science will have strong technical backgrounds in computer science.
2. Graduates with degrees in Computer Science will have additional specialized skills for employment in computer related fields.
3. Graduates with degrees in Computer Science will have a positive image of their undergraduate education.
4. Graduates with degrees in Computer Science will understand the values and requirements of responsible professionalism including the necessity of ethical behavior, the impact of computing technologies in society, appreciation for life-long learning, and the need for professional relationships.
5. Faculty in Computer Science will enjoy an environment in which they can develop and apply their abilities in teaching, research, and service.

Bachelor of Science
Major in Computer Science
Minimum required: 128-129 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Minor fields of study may be chosen from the list of approved minors. Advanced Computer Science electives are recommended for additional required hours after satisfying the minor requirements, but not more than six hours beyond the major requirements can be used as open electives. Mathematics is recommended, but no more than six hours beyond the minor requirements can be used as open electives.
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 16 hours from: BIO 1430, 1431; PHYS 1410, 1420 or 1430, 2425; CHEM 1141 and 1341, 1142 and 1342; or GEOL 1410, 1420. Eight of the 16 hours must be from the same science (BIO, CHEM, GEOL, OR PHYS) listed above.
5. 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.
6. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year - 1st Semester	**Hours**
CS 1428	4
COMM 1310	3
US 1100	1
ENG 1310	3
HIST 1310	3
MATH 2358	3
PFW one course	1
Total	**18**

Freshman Year - 2nd Semester	**Hours**
CS 2308	3
ENG 1320	3
HIST 1320	3
MATH 2471	4
PHIL 1305	3
PFW one course	1
Total	**17**

Sophomore Year - 1st Semester	**Hours**
CS 3358	3
MATH 2472, 3398	7
Elective (see general requirements 1 and 5)	4
Science (see general requirements 4)	4
Total	**18**

Sophomore Year - 2nd Semester	**Hours**
CS 2315, 2318, 3409	10
Elective (see general requirements 1 and 5)	4
Science (see general requirements 4)	4
Total	**18**

Junior Year - 1st Semester	**Hours**
CS 3398	3
MATH 3305	3
ENG Literature or 3303 or 3313	3
Science (see general requirements 4)	4
CS advanced elective	3
Total	**16**

Junior Year - 2nd Semester	**Hours**
ENG Literature (see general requirements 6)	3
Science (see general requirements 4)	4
Social Science component (see general requirements 6)	3
Elective (see general requirements 1)	3
CS 3339	3
Total	**16**

Senior Year - 1st Semester	**Hours**
CS advanced electives	6
POSI 2310	3
CS 4354	3
Total	**12**

Senior Year - 2nd Semester	**Hours**
CS 3468 or 4326 or 4398	3-4
CS elective	1
ART, DAN, MU, or TH 2313	3
POSI 2320	3
Elective (see general requirements 1)	3
Total	**13-14**

Bachelor of Arts
Major in Computer Science
Minimum required: 128-129 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Minor fields of study may be chosen from the list of approved minors. Advanced Computer Science electives are recommended for additional required hours after satisfying the major requirements, but no more than six hours beyond the major/minor requirements can be used for open electives.
3. The student must take eight hours from: BIO 1430, 1431; PHYS 1410, 1420 or 1430, 2425; CHEM 1141 and 1341, 1142 and 1342; or GEOL 1410, 1420. The eight hours must be from the same science (BIO, CHEM, GEOL, or PHYS) as listed above.
4. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year - 1st Semester	**Hours**
CS 1428	3
COMM 1310	3
US 1100	1
ENG 1310	3
HIST 1310	3
MATH 1315, 1319, or higher	3
Total	**16**

Freshman Year - 2nd Semester	**Hours**
CS 2308	3
ENG 1320	3
HIST 1320	3
MATH 2358	3
PHIL 1305	3
PFW one course	1
Total	**16**

Sophomore Year - 1st Semester	**Hours**
CS 3358	3
MATH 3398	3
Modern Language 1410	4
Science (see general requirements 3)	4
CS 2315	3
Total	**17**

Sophomore Year - 2nd Semester	**Hours**
CS 2318, 3409	7
Modern Language 1420	4
Social Science Component (see general requirements 4)	3
Science (see general requirements 3)	4
Total	**18**

Junior Year - 1st Semester	**Hours**
CS 3398	3
ENG Literature or ENG 3303 or 3313	3
Electives/Minor (see general requirements 1 & 2)	3
PFW one course	1
Modern Language 2310	3
MATH	3
Total	**16**

Junior Year - 2nd Semester	**Hours**
CS advanced electives	6
Electives/Minor (see general requirements 1 & 2)	3
Modern Language 2320	3
ENG Literature (see general requirements 4)	3
Total	**15**

Senior Year - 1st Semester	**Hours**
CS advanced electives	2
CS 4354	3
POSI 2310	3
Electives/Minor (general requirements 1 & 2)	6
Total	**14**

Senior Year - 2nd Semester	**Hours**
CS 3468, 4326, or 4398	3-4
ART, DAN, MU, or TH 2313	3
POSI 2320	3
Electives/Minor (general requirements 1 & 2)	6
Total	**15-16**

Teacher Certification

Students seeking certification to teach Computer Science will follow coursework leading to the BA or BS degree and will take courses approved by the State Board for Educator Certification. A teaching field in Computer Science requires 22 hours of the following courses: 1428, 2308, 2318, 3358, and 12 hours of CS electives of which 9 hours must be

advanced. 21 hours of Education block courses are also required and can be found at the front of the College of Science page. Initial or additional certification may be acquired after completing the bachelor's degree, while enrolled in a master's program, or as post-graduate 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 CS 1428, 2308, 2318, 3358, 3409 and at least six advanced CS hours. MATH 2358 and 3398 are also required as prerequisites for CS 3358 and 3409.

Courses in Computer Science (CS)

NOTE: Descriptions of the topics courses listed below are available through the department's web site: http://www.cs.txstate.edu/courses/undergrad_courses.shtml.

1308 (COSC 1300) Computer Literacy and the Internet. (2-2) A study of the uses of computers and their effects on society. Text processing, spreadsheets, databases, and web programming. Does not count for computer science credit towards a minor, a BS, or a BA in computer science.

1318 Computer Science Fundamentals. (3-0) Provides fundamental knowledge of the six layers of computer science as per the ACM CS0 curriculum. The information, hardware, programming, operating system, applications, and communications layers are presented plus appropriate open computer laboratory exercises. Does not count for computer science credit towards a minor, BS, or BA in computer science.

1428 Foundations of Computer Science. (3-2) This is 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 or corequisite: MATH 1315.

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 1428. Prerequisite: CS 1428 with a grade of "C" or higher.

2315 Computer Ethics. (3-0) Primarily for computer science majors, focusing on the ethical codes of the professional societies, the philosophical bases of ethical decision-making, and the examination of several contemporary case studies. Prerequisites: CS 1318 or 1428, ENG 1310, COMM 1310, and PHIL 1305 with a grade of "C" or higher.

2318 (COSC 2325) 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. Prerequisite: MATH 2358 with a grade of "C" or higher. Prerequisite or Co-requisite: CS 2308 with a grade of "C" or higher.

2320 Internet Programming with Database Applications. (3-0) A course providing foundations for the construction and design of static and dynamic web pages with database applications. This will include server-side and client-side programming applications. Prerequisite: CS 2308 or consent of instructor.

2358 Introduction to Data Structures. (3-0) A course covering classic data structures and an introduction to object-oriented development. Prerequisite: CS 2308 with a grade of "C" or higher. Co-requisite: MATH 3398.

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. Does not count for computer science credit towards a minor, BS, or BA in computer science.

2428 Applications Programming in Visual Basic. (3-2) A self-contained programming course using Visual Basic. Does not count for computer science credit towards a BS in computer science.

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: CS 2315, 2318, and 3409 with a grade of "C" or higher.

3358 Data Structures. (3-0) A course covering classic data structures and an introduction to object-oriented development. Prerequisite: CS 2308 with a grade of "C" or higher. Prerequisite or Co-requisite: MATH 3398 with a grade of "C" or higher.

3378 Theory of Automata. (3-0) An introduction to automata theory, computability, and formal languages. Prerequisite: CS 3358 with a grade of "C" or higher.

(WI) **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: CS 2315 and 3358 with a grade of "C" or higher.

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: MATH 2358 with a grade of "C" or higher. Prerequisite or Co-requisite: CS 2318 with a grade of "C" or higher.

(WI) **3468 Embedded Computer Systems.** (3-2) Studies the architecture of embedded systems, micro-controllers, their peripherals, languages, and operating systems and the special techniques required to use them. Prerequisites: CS 2318, 3409 with a grade of "C" or higher.

4100 Computer Science Internship. (1-0) Provides on-the-job training supervised by computer scientists in industry internship programs approved by the 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: CS 3358 with a grade of "C" or higher.

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

(WI) **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: CS 3358 with a grade of "C" or higher.

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

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

4335 Digital Signal Processing. (3-0) The course will introduce the techniques of discrete-time systems, Z transform analysis, and filter design techniques, including lab programming with National Instruments LabVIEW and TI signal processors. Prerequisites: MATH 2472 and CS 3358 with grades of "C" or higher.

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

4350 Unix Systems Programming. (3-0) Fundamentals of Unix operating systems, Unix file system and environment, C memory allocation, development tools, processes and signals, threads, device drivers, and programming for security. Prerequisite: CS 3358 with a grade of "C" or higher.

4354 Object-Oriented Design and Implementation. (3-0) An in-depth knowledge of object-oriented design and implementation issues with emphasis on understanding the life cycle of object-oriented software, Unified Modeling Language (UML), inheritance and polymorphism, designing remote and persistent objects, and exception handling. Prerequisite: 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: CS 3358 with a grade of "C" or higher.

4371 Computer System Security. (3-0) Course covers practical aspects of computer system security including managing and producing code for secure systems. Theory, such as cryptograpy, is introduced as needed. Prerequisite: CS 4350 with a grade of "C" or higher.

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

4378U Data Mining (3-0)

4388 Computer Graphics. (3-0) A study of the hardware and software used in graphic representation and interpretation of data. Prerequisites: CS 3358 with a grade of "C" or higher 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. Requires department chair approval. Repeatable for credit with different emphasis.

(WI) **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: CS 3398 with a grade of "C" or higher.

Department of Engineering and Technology

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Degree Programs Offered

- BS, major in Industrial Engineering
- BS, major in Manufacturing Engineering
- BST, major in Engineering Technology
- BST, major in Industrial Technology

Minors Offered

- Technology

The mission of the Department of Engineering and Technology 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, 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.

The BS with a major in Industrial Engineering provides students the background that is essential for improving the productivity, quality, safety, and cost effectiveness of all types of systems and processes. Industrial engineers are typically engaged in the areas of quality assurance, ergonomics, production & operations management, facilities design, work design, system optimization, information technology, and industrial safety.

The BS with a major in Manufacturing Engineering is designed to provide students with the mathematics, science, management, engineering, and applications skills needed to become manufacturing engineers. These engineers are typically responsible for promoting manufacturability, process planning, tool design, cost estimation, factory layout, work methods, quality assurance, automation, and systems integration. The degree has a concentration in general manufacturing or semiconductor/high technology manufacturing.

The BST in Engineering Technology provides students with the technical background to work with engineers in planning production processes, developing tooling, establishing quality assurance procedures, developing safety programs, establishing work methods, and setting time standards. Students can specialize in Plant Production Systems (Manufacturing), Community Systems (Construction), Environmental Systems, or Communications Systems.

The BST in Industrial Technology degree prepares students for work in industry in middle management positions. Students gain a sound knowledge and understanding of materials, processes, industrial safety, and concepts of industrial management. This degree has program majors in Construction, Manufacturing, 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.

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.

Bachelor of Science
Major in Industrial Engineering
Minimum required: 137 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Six hours of IE electives to be chosen from: HA 3308, 3340; HIM 3310, 3363; IE 4330, 4340; MFGE 4395; TECH 2330, 4330, 4367, 4391, or 4392.
3. Departmental requirements that also satisfy the general education core curriculum requirements for the following components: mathematics- MATH 2471; natural science- CHEM 1341/1141 and 1342/1142; and social science- ECO 2301. See the University College section of this catalog for the English literature requirements.
4. 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.

Freshman Year - 1st Semester	**Hours**
CHEM 1341, 1141	4
ENG 1310	3
ENGR 1413	4
HIST 1310	3
MATH 2471	4
US 1100	1
Total	**19**

Freshman Year – 2nd Semester	**Hours**
CHEM 1342, 1142	4
ENG 1320	3
ENGR 2300	3
HIST 1320	3
MATH 2472	4
Total	**17**

Sophomore Year - 1st Semester	**Hours**
PHYS 1430	4
COMM 1310	3
MATH 3323	3
POSI 2310	3
TECH 2332	3
Total	**16**

Sophomore Year – 2nd Semester	**Hours**
ECO 2301	3
ENGR 3311	3
MATH 3375	3
PHYS 2425	4
POSI 2320	3
Total	**16**

Junior Year - 1st Semester	**Hours**
CS 1428	4
ENG Literature (see general requirement 3)	3
ENGR 3373	3
IE 3320	3
PFW course	1
PHIL 1305	3
Total	**17**

Junior Year – 2nd Semester	**Hours**
ART, DAN, MU, or TH 2313	3
IE 3310	3
IE 3330	3
IE 3340	3
MGT 3303	3
PFW course	1
Total	**16**

Senior Year - 1st Semester	**Hours**
ENGR 3315	3
MFGE 4376	3
TECH 4345	3
TECH 4357	3
TECH 4380	3
IE Elective (see general requirement 2)	3
Total	**18**

Senior Year – 2nd Semester	**Hours**
IE 4310	3
IE 4320	3
IE 4350	3
IE 4360	3
MFGE 4396	3
IE Elective (see general requirement 2)	3
Total	**18**

Bachelor of Science
Major in Manufacturing Engineering
(with General Manufacturing Curriculum)

Minimum required: 137 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Manufacturing Processes elective to be chosen from: TECH 1330, 2330, 4330, 4367, or 4392.
3. Manufacturing Systems Management elective chosen from: TECH 4357, 4380, or MATH 3348.
4. Departmental requirements that also satisfy the general education core curriculum requirements for the following components: mathematics- MATH 2471; natural science- CHEM 1341/1141 and 1342/1142; and social science- ECO 2301.
5. 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.

Freshman Year - 1st Semester	**Hours**
US 1100	1
CHEM 1141, 1341	4
ENG 1310	3
HIST 1310	3
MATH 2471	4
ENGR 2300	3
Total	**18**

Freshman Year - 2nd Semester	**Hours**
PHYS 1430	4
ENGR 1413	4
TECH 2332	3
ENG 1320	3
HIST 1320	3
Total	**17**

Sophomore Year - 1st Semester	**Hours**
MATH 2472, 3375	7
COMM 1310	3
POSI 2310	3
CHEM 1142, 1342	4
Total	**17**

Sophomore Year - 2nd Semester	**Hours**
PHYS 2425	4
MATH 3323	3
POSI 2320	3
ECO 2301	3
ENGR 3311	3
Total	**16**

Junior Year - 1st Semester	**Hours**
ENG Literature (see general requirements 4)	3
CS 1428	4
PHIL 1305	3
IE 3320	3
PFW one course	1
ENGR 3373	3
Total	**17**

Junior Year - 2nd Semester	**Hours**
ART, DAN, MU, TH 2313	3
TECH 3364, 4374	6
MGT 3303	3
PFW one course	1
ENGR 3316	3
Total	**16**

Senior Year - 1st Semester	**Hours**
Manufacturing Processes Elective (see general requirements 2)	3
TECH 4345, 4391	6
ENGR 3315	3
MFGE 4363, 4376	6
Total	**18**

Senior Year - 2nd Semester	**Hours**
Manufacturing Processes Elective (see general requirements 2)	3
MGT 4330	3
Manufacturing Systems Management Elective (see general requirements 2)	3
MFGE 4365, 4395, 4396	9
Total	**18**

Bachelor of Science
Major in Manufacturing Engineering
(with Semiconductor Manufacturing Curriculum)

Minimum required: 137 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Semiconductor Manufacturing elective to be chosen from: PHYS 4320, 4340, or TECH 4394.
3. Manufacturing Systems Management elective chosen from: TECH 4357, 4380, or MATH 3348.
4. Departmental requirements that also satisfy the general education core curriculum requirements for the following components: mathematics- MATH 2471; natural science- CHEM 1341/1141 and 1342/1142; and social science- ECO 2301. See the University College section of this catalog for the English literature requirements.
5. 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.

Freshman Year - 1st Semester	**Hours**
US 1100	1
CHEM 1141, 1341	4
ENG 1310	3
HIST 1310	3
COMM 1310	3
ENGR 1413	4
Total	**18**

Freshman Year - 2nd Semester	**Hours**
PHYS 1430	4
ENGR 2300	3
ENG 1320	3
TECH 2332	3
MATH 2471	4
Total	**17**

Sophomore Year - 1st Semester	**Hours**
MATH 2472, 3375	7
HIST 1320	3
POSI 2310	3
CHEM 1142, 1342	4
Total	**17**

Sophomore Year - 2nd Semester	**Hours**
PHYS 2425	4
MATH 3323	3
POSI 2320	3
ECO 2301	3
ENGR 3311	3
Total	**16**

Junior Year - 1st Semester	**Hours**
ENG Literature (see general requirement 4)	3
CS 1428	4
PHIL 1305	3
IE 3320	3
PFW one course	1
ENGR 3373	3
Total	**17**

Junior Year - 2nd Semester	**Hours**
TECH 3364, 4374, 4392	9
MGT 3303	3
PFW one course	1
ENGR 3316	3
Total	**16**

Senior Year - 1st Semester	**Hours**
ART, DAN, MU, or TH 2313	3
TECH 4345, 4375	6
ENGR 3315	3
MFGE 4363, 4376	6
Total	**18**

Senior Year - 2nd Semester	**Hours**
Semiconductor Manufacturing Elective (see general requirement 2)	3
MGT 4330	3
Manufacturing Systems Management Elective (see general requirement 3)	3
MFGE 4365, 4395, 4396	9
Total	**18**

Bachelor of Science in Technology
Major in Industrial Technology

Minimum required: 130-139 semester hours

General Requirements:

1. Majors must take the following courses to fulfill the industrial technology core requirements (24 hours min.): TECH 2344, 2370, 3364, 4380, 4390 (repeat for a total of six semester credit hours during summer sessions only); MGT 3303; and ENG 3303.
2. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
3. Departmental requirements that also satisfy the general education core curriculum requirements for the following components: mathematics- MATH 1315 (Manufacturing and General majors) or MATH 2417 (Construction majors); natural science- CHEM 1341/1141 and PHYS 1410; and social science- ECO 2301. See the University College section of this catalog for the English literature requirements.
4. 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.

Freshman Year	**Hours**
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
Industrial Technology Core (see general requirement 1)	3
Industrial Technology Specializations	6
MATH 1315 or 2417 (see general requirement 3)	3-4
PHIL 1305	3
COMM 1310	3
Total	**31-32**

Sophomore Year	**Hours**
CHEM 1141, 1341	4
ENG Literature (see general requirement 1)	3
Industrial Technology Core (see general requirement 1)	6
Industrial Technology Specializations	9
PHYS 1410	4
POSI 2310, 2320	6
Total	**32**

Junior Year	**Hours**
ART, DAN, MU, or TH 2313	3
ECO 2301	3
Industrial Technology Core (see general requirement 1)	6
Industrial Technology Specializations	21-23
PFW one course	1
Total	**34-36**

Senior Year	**Hours**
TECH 4390 (two sections)	6
Industrial Technology Core (see general requirement 1)	3
Industrial Technology Specializations	23-25
PFW one course	1
Total	**33-35**

Industrial Technology Specializations

All industrial technology students must select one of the following three programs (57-68 minimum hours):

Construction Technology (61 hours)**:** TECH 1260, 1330, 2313, 2342, 2360, 3313, 3361, 3362 or 3363, 4313, 4360, 4361, 4364, 4368, 4369; MATH 2328; PHYS 1420; ENGR 3315; AG 3455; BLAW 2361; MGT 3340.

Manufacturing Technology (59-60 hours)**:** TECH 1330, 2310, 2330, 3310, 4330, 4345, 4357, 4362, 4373, 4374, 4391, six hours of advanced TECH electives; ENGR 2300; GEO 3303; MGT 4330; PHYS 1420; CHEM 1142, 1342; MATH 1317 or 2417.

General Technology (59-60 hours)**:** four lower-level TECH electives (12 hours min.), six upper-level TECH electives (18 hours min.), TECH 3310, 3322, 4345, 4357; GEO 3303; MGT 4330; CHEM 1342, 1142; PHYS 1420; MATH 1317 or 2417.

Bachelor of Science in Technology
Major in Industrial Technology (with teacher certification)

Minimum required: 129 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Departmental requirements that also satisfy the general education core curriculum requirements for the following components: mathematics- MATH 1315 and natural science- CHEM 1341/1141 and PHYS 1410. See the University College section of this catalog for the English literature and social science requirements.
3. 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.

Freshman Year	**Hours**
ENG 1310, 1320	6
PHIL 1305	3
HIST 1310, 1320	6
MATH 1315	3
TECH 1320, 1330	6
CHEM 1141, 1341	4
US 1100	1
PFW one course	1
ENGR 1413	4
Total	**34**

Sophomore Year	**Hours**
COMM 1310	3
ENG Literature (see general requirement 2)	3
POSI 2310, 2320	6
PHYS 1410	4
TECH 2310, 2330, 3322	9
PFW one course	1
TECH electives	6
Total	**32**

Junior Year	**Hours**
ENG 3303	3
CI 3310, 3325	6
MGT 3303	3
TECH 2344, 2360, 2370, 3310, 3313, 4374	18
Total	**30**

Senior Year	**Hours**
ART, DAN, MU, or TH 2313	3
Social Science Component (see general requirement 2)	3
CI 4332, 4343	6
ED 4681	6
RDG 3323	3
TECH 4360, 4362, 4380	9
TECH advanced elective (see general requirements 1)	3
Total	**33**

Bachelor of Science in Technology
Major in Engineering Technology

Minimum required: 135-136 semester hours

General Requirements:

1. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
2. Departmental requirements that also satisfy the general education core curriculum requirements for the following components: mathematics- MATH 2471 and natural science- CHEM 1341/1141 and CHEM 1342/1142. See the University College section of this catalog for the English literature and social science requirements.
3. 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.

Freshman Year	Hours
CHEM 1141, 1341	4
CHEM 1142, 1342	4
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
MATH 2471, 2471	8
PHIL 1305	3
ENGR 2300	3
Total	**35**

Sophomore Year	Hours
MATH 3323	3
IE 3320	3
PFW courses	2
PHYS 1430, 2425	8
POSI 2310, 2320	6
TECH 2344	3
Engineering Technology Specialization	6
COMM 1310	3
Total	**34**

Junior Year	Hours
ART, DAN, MU, or TH 2313	3
Social Science Component (see general requirement 2)	3
ENG 3303	3
ENG Literature (see general requirement 2)	3
MATH 3348	3
PHYS 3315 or 3417	3-4
TECH 3322, 3364, 4345, 4374	12
ENGR 3311	3
Total	**33-34**

Senior Year	Hours
TECH 4390 (2 sections)	6
ENGR 3315	3
Engineering Technology Specialization	18
MGT 3303	3
MATH 3375	3
Total	**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: TECH 2310, 4372, 4373, 4375, and 4399; plus 9 hours selected from the following: TECH 3370, 4380; CS 2308; CIS 2324, 3380.

Community Systems: TECH 2313, 2360, 3313, 3361, 4313, 4360, 4361, 4364.

Environmental Systems: TECH 2310, 4362, 4380; GEO 4313, 4338, 4350; plus 6 hours selected from the following: TECH 4330; GEO 3320, 3321; CHEM 4331.

Plant Production Systems: TECH 2310, 2330, 4330, 4362, 4391; MGT 4330; plus 6 hours from the following: TECH 4357, 4380; MGT 4373, 4377; SOCI 3370.

Minor in Technology

A minor in Technology requires 18 hours, of which 9 hours must be advanced. Courses will be determined by conference with a departmental advisor or the Chair of the Department.

Driver and Traffic Safety Education Certification

Students seeking State of Texas Certification in Driver's Education must complete nine semester hours of TECH 4383, 4385, and 4393. For more information on this program contact the Director of the Traffic Safety Center.

Courses in Engineering (ENGR)

1413 Engineering Design Graphics. (3-3) Fundamentals of graphics and modeling that are used for the communication of an engineering design are presented. Sketching, multi-view projections, solid modeling, generation of engineering drawings and rapid prototyping are included with emphasis on design problem solving. Prerequisite: Approval of advisor.

2300 Materials Engineering. (3-0) Structure, properties and behavior of engineering materials including metals, polymers, composites and ceramics. Mechanical, electrical, magnetic, thermal, and optical properties are covered. Prerequisites: MATH 1315; CHEM 1341; and approval of advisor.

3190 Cooperative Education. (0-1) Completion of technical/engineering practice-related special projects. Projects must relate to students' major and result in a term paper. Prerequisite: Approval of advisor.

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. Prerequisites: MATH 3375 and approval of advisor.

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 approval of advisor.

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; engineering standards; ethical aspects of design safety, risk, and liability; and rapid prototyping. Prerequisites: ENGR 1413, 3311; TECH 2332; and approval of advisor.

3360 Structural Analysis. (3-1) Structural engineering fundamentals to include design loads, reactions, force systems, functions of a structure, and the analysis of statically determinate and indeterminate structures by classical and modern techniques. Prerequisites: ENGR 3311 and approval of advisor.

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. Prerequisites: PHYS 2425 and approval of advisor.

Courses in Industrial Engineering (IE)

(WI) **3310 Project Planning, Scheduling, and Management.** (3-0) Basic principles governing the efficient and effective management of engineering projects. Topics include project planning, scheduling, and cost estimation procedures. Prerequisite: Approval of advisor.

3320 Engineering Statistics. (3-0) Fundamentals of probability and statistical inference for engineering applications, probability distributions, parameter estimation, hypothesis testing, and analysis of variance. Prerequisites: MATH 2472 and approval of advisor.

3330 Quality Engineering. (3-0) Quality assurance systems, quality costs, statistical quality control, and approaches for engineering quality into products and processes. Prerequisites: IE 3320 and approval of advisor.

3340 Operations Research. (3-0) Introduction to deterministic and probabilistic models in operations research to include linear programs, network flows, integer programs, queuing systems, and simulation. Emphasis will be placed on modeling applications to problems in the industrial and service sectors. Prerequisites: IE 3320 and approval of advisor.

4310 Design of Industrial Experiments. (3-0) Experimental design for engineering applications. Topics include factorial designs, fractional factorial designs, response surface methodology, evolutionary operations, and the design of robust products and processes. Prerequisites: IE 3320 and approval of advisor.

4320 Integrated Production Systems. (3-0) Basic concepts in the design and control of integrated production systems to include forecasting, inventory models, material requirements planning, scheduling, planning, and shop floor control. Coverage will include both traditional and kanban systems. Prerequisites: IE 3340 and approval of advisor.

4330 Reliability Engineering. (3-0) Reliability of components and systems, reliability models, life testing, failure analysis, and maintainability. Prerequisites: IE 3320 and approval of advisor.

4340 Optimization Techniques. (3-0) Mathematical modeling and computational methods for linear, integer, and nonlinear programming problems. Prerequisites: IE 3340 and approval of advisor.

4350 Supply-Chain Engineering. (3-0) The analysis of supply chain problems to include facility location, customer assignment, vehicle routing, inventory management, and the role of information and decision support systems in supply chains. Prerequisites: IE 3340 and approval of advisor.

(WI) **4360 Human Factors Design.** (3-1) Capstone course emphasizing the applications of human factors engineering to systems design. Prerequisites: IE 3320; TECH 4345; and approval of advisor.

Courses in Manufacturing Engineering (MFGE)

(WI) **4363 Concurrent Process Engineering.** (2-3) Integrated design and development of products and processes; impact of ethical issues on design; the discussion of real-world engineering problems and emerging engineering issues with practicing engineers; preparation of reports; plans or specifications; cost estimation; project management, communication and the fabrication of an engineered product/system. Prerequisites: ENGR 3316 and approval of advisor.

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: TECH 2332; ENGR 3316; and approval of advisor.

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; PHYS 1430; TECH 2332; and approval of advisor.

(WI) **4395 Computer Integrated Manufacturing.** (3-1) An overview of computer integrated manufacturing is presented. Topics include control strategies for manufacturing systems, automated material handling systems, production planning, shop floor control, manufacturing execution systems, manufacturing databases and their integration, data communication and protocols and man/machine interfaces. Prerequisites: TECH 4375 or 4391 and approval of advisor.

(WI) **4396 Manufacturing Systems Design.** (3-2) Applications of simulation modeling to the design and analysis of manufacturing systems are presented in this course. 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; TECH 2332; and approval of advisor.

Courses in Technology (TECH)

1260 Introduction to the Construction Industry. (2-0) An introductory course for construction majors. Residential, commercial, heavy, and highway construction are explored, along with contract delivery systems and typical professional careers and organization found in the industry. Also, the role of construction in the United States and world economics is explored, along with green sustainable building and design.

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: ENGR 1413 or 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.

1413 Introduction to Architectural Graphics. (3-3) An introductory manual drafting course utilizing the tools and techniques necessary to produce architectural working drawings.

Principles of orthographic and perspectives, projections, geometric relationships, shape and size description, and pictorial methods are included with emphasis on technical applications and architectural design problem solving. Prerequisite: Interior Design and non-Engineering or Technology majors only.

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: ENGR 1413 or consent of instructor.

2313 Fundamentals of Architectural Problem-Solving and Design. (3-3) Introduction to the language of architectural design. Use of the computer and CAD software in the design process. Elements of projection theory to include orthographic and perspective projection. Solving complex problems of building geometry. Section views and their relationship to architectural detailing. Emphasis on the successful integration of construction documents.

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) 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 design through manufacture activities of product cycle. Prerequisite: ENGR 2300.

2342 Construction Materials and Processes. (3-1) This course will introduce students to various types of construction materials including ceramics, ferrous, non-ferrous, and organic materials used in construction. Their properties, working characteristics, and processes used to manufacture and assemble these materials are studied. Laboratory activities are used to reinforce lecture material. Prerequisite: MATH 1315.

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.

2360 Residential Construction Systems. (2-3) A residential construction course, which deals with interpreting plans and specifications, along with studying site work, foundations, walls, roofing, ceilings, floor, and finishing systems. Also, residential MEP systems are covered along with applicable building codes and construction financing.

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.

3313 Architectural Design II. (3-3) Architectural CAD techniques and principles of residential and/or light commercial design and construction. Exterior and interior drawings and details; essentials of plans, elevations, sections, and perspective aspects of architectural documents. Structural, MEP's, ADA and green-building issues are discussed. Individual and group projects will be completed by students. Prerequisite: ENGR 1413 or TECH 1413.

(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.

3361 Commercial Building Construction Systems. (3-0) A commercial building construction systems class that deals with soils, site work, heavy foundations, steel, reinforced concrete, and pre-cast structures along with common assemblies. Commercial MEP's are studied along with CSI master format, as-built and shop drawings, schedule of values, AIA documents, and appropriate building codes. Prerequisite TECH 2360

3362 Industrial and Offshore Construction Systems. (3-1) Management of the design process for oil and gas production facilities with emphasis on developing projects outside the United States. Presentation of materials, methods, and techniques of industrial facility construction and marine environments centers on equipment and crew selection, productivity, cost estimation, and constructability. Required field trip. Prerequisite: TECH 2342.

3363 Heavy, Civil, and Highway Construction Systems. (3-1) Selection, acquisition, and capabilities of heavy construction equipment are presented. Applications of economics to performance characteristics and production of equipment is discussed. Sector-specific construction management methods are covered, including unit price estimating, equipment fleet design, repetitive scheduling, and major components of highways, bridges, and engineered facilities. Prerequisite: TECH 2342.

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.

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: TECH 2370.

4197 Special Problems. (1-0) 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. Repeatable for credit with different emphasis.

4310 Technical Architectural Drafting. (3-3) Architectural plans, renderings, and detailing including case, millwork and cabinet detailing concepts are taught in this class using contemporary computer aided design (CAD) software. Repeatable for credit with different emphasis. Prerequisite: ENGR 1413 or TECH 1413.

4313 Architectural Design III. (3-3) Architectural CAD techniques and principles of commercial construction. Exterior and interior drawings and details; essentials of plans, elevations, sections, and perspective aspects of architectural documents. Structural, mechanical, electrical, plumbing, ADA and green building issues are discussed. Design and/or construction documents will be produced through group participation projects. Prerequisite: TECH 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) 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. 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. ENGR 2300 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.

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 Construction Contract Administration and Site Organization. (2-3) Construction contracts including lump sum and cost reimbursable are covered, along with delivery systems, insurance, bonding, AIA documents, specifications, addenda, general conditions, change orders, RFI's and ethics are covered. Selected structures are designed, scheduled, and built, complete with specifications and particular attention to work site organization. Recommended prerequisites: TECH 2313 and 2360.

4361 Construction Estimating. (2-3) The fundamentals of construction estimating are covered including feasibility, conceptual, square feet, cubic feet, unit in place, preliminary, engineering, range and contractor's detail bid estimates. Plans and specifications are used along with contemporary estimating software to develop estimates commonly used in the construction industry. Prerequisite: TECH 2360. Recommended: TECH 4360.

4362 Manufacturing Processes I. (1-3) 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 contributes 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: TECH 2330.

4364 Construction Project Management and Scheduling. (3-1) Concepts of construction management are studied beginning with contract documents through the effective management of manpower, machines, material, and money necessary to complete construction projects on time and within budget. Gantt Charts and PERT/CPM schedules are developed, using contemporary software. Prerequisite: TECH 4361 or consent of instructor.

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: TECH 2332.

4368 Environmentally Sustainable Design and Construction. (3-1) Environmentally sustainable practices used in building design and construction. The LEED system will be used to guide the course, which covers aspects of sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and the CAD design process. Prerequisite: TECH 3313 and 2360 or ID 2329.

4369 Construction Contracts, Liability, and Ethics. (3-0) Legal aspects of design and construction contract documents are presented, including contract formation, interpretation, rights and duties, and changes. Legal liabilities are explored in the context of professional ethics for design firms and constructors. Recommended MGT 3340.

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: TECH 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: TECH 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: TECH 2370 or PHYS 2425.

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

(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. TECH 4383 and 4385 will be taken simultaneously. Prerequisites: TECH 4383 and a good driving record.

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 BS in Technology program.

(WI) **4390 Internship.** (0-20) Supervised on-the-job professional learning experience in construction, manufacturing, electronics, and other technical areas. Two sections (six credit hours) required by all Industrial and Engineering Technology majors during the summer of their junior or senior year. Repeatable for credit. Prerequisites: Consult internship coordinator.

4391 Manufacturing Processes II. (1-3) Involves a wide variety of advanced manufacturing techniques. Included 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: TECH 2330, 4362; MATH 1315.

4392 Microelectronics Manufacturing I. (3-0) Provides an overview of integrated circuit fabrication including crystal growth, wafer preparation, epitaxial growth, oxidation, diffusion, ion-implantation, thin file deposition, lithography, etching, device and circuit formation, packaging and testing. Lab component involves 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: TECH 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.

4397 Special Problems. (3-0) 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. Repeatable for credit with different emphasis.

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. Repeatable for credit with different emphasis.

Department of Mathematics

Phone: (512) 245-2551 Office: Math/Computer Science Building 470
Fax: (512) 245-3425 Web: http://www.txstate.edu/math/welcome.html/

Degree Programs Offered

- BA, major in Mathematics
- BS, major in Mathematics
- BS, major in Applied Mathematics

Minor Offered

- Mathematics

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.

Majors

The department offers the Bachelor of Arts and the Bachelor of Science majors in Mathematics with or without teacher certification and the Bachelor of Science with a major in Applied Mathematics. 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 MATH 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, and 4330 plus any two of the following courses: 3305, 3323, 3325, 3348, 3375, 3377, 3398, 3428, 4305, 4306, 4336, or 4382. The second is the certification plan and consists of 3305, 3315, 3377, 4304 and 4311. Notice that MATH 3315, 4302, 4304 and 4311 are not in the list of elective courses when taking the plan that includes MATH 3373. Even though MATH 2471 is the first required mathematics course, some students will need to take courses numbered below 2471. Credit examinations in MATH 1315, 1317 and 2471 are available.

For the BS, a major in applied mathematics requires at least 32 semester hours, including Math 2471, 2472, 3305, 3323, 3373, 3377 and 12 semester hours from Math 3348, 3375, 3398, 4305, 4306, 4336.

Pre-engineering course work should include MATH 2472, 2471, 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.

Teacher Certification

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

Bachelor of Arts
Major in Mathematics
Minimum required: 128-129 semester hours

General Requirements:

1. At least 32 hours are required in mathematics and must include MATH 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 MATH 3373, 4315, and 4330; and any two of the following courses: MATH 3305, 3323, 3325, 3348, 3375, 3377, 3398, 4305, 4306, 4336, or 4382. The second consists of MATH 3305, 3315, 4304, and 4311.
2. Even though MATH 2471 is the first required mathematics course, some students will need to take courses numbered below 2471. Credit examinations in MATH 1315, 1317, and 2471 are available.
3. Four hours in a scientific programming language are required in computer science (CS 1428).
4. Students are required to complete 2310 and 2320 in a modern language.
5. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
6. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	**Hours**	**Sophomore Year**	**Hours**
COMM 1310	3	CS 1428	4
Electives	3	ENG Literature (see general requirement 6)	6
ENG 1310, 1320	6	MATH 2472, 3330	7
US 1100	1	Minor	6
HIST 1310, 1320	6	Modern Language 1410, 1420	8
MATH 2471	4	PHIL 1305	3
PFW two courses	2		
Natural Science Component	7-8		
Total	**32-33**	**Total**	**34**

Junior Year	**Hours**	**Senior Year**	**Hours**
ART, DAN, MU, or TH 2313	3	Electives	8-10
MATH 3377, 3380	6	MATH 4307	3
MATH advanced elective	3	MATH advanced electives	9
Minor	9	Minor/Electives	6
Modern Language 2310, 2320	6	Social Science Component (see general requirement 6)	3
POSI 2310, 2320	6		
Total	**33**	**Total**	**29**

Bachelor of Science
Major in Mathematics
Minimum required: 128-131 semester hours

General Requirements:

1. At least 32 hours are required in mathematics and must include MATH 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 MATH 3373, 4315, and 4330; and any two of the following courses: MATH 3305, 3323, 3325, 3348, 3375, 3377, 3398, 4305, 4306, 4336, or 4382. The second consists of MATH 3305, 3315, 4304, and 4311.
2. Even though MATH 2471 is the first required mathematics course, some students will need to take courses numbered below 2471. Credit examinations in MATH 1315, 1317, 2363 and 2471 are available.
3. Four hours in a scientific programming language are required in computer science (CS 1428).
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.

5. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
6. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	Hours
COMM 1310	3
Electives	3
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
MATH 2471	4
Minor	8
PFW two courses	2
Total	**33**

Sophomore Year	Hours
CS 1428	4
ENG Literature (see general requirement 6)	3
ENG 3303	3
MATH 2472, 3330	7
Minor	12-16
PHIL 1305	3
Total	**32-34**

Junior Year	Hours
ART, DAN, MU, or TH 2313	3
MATH 3377, 3380	6
MATH advanced elective	3
Minor/Electives	6
POSI 2310, 2320	6
Natural Science Component (see general requirement 6)	7-8
Total	**31-32**

Senior Year	Hours
Electives (see general requirement 5)	17
MATH 4307	3
MATH advanced electives	9
Social Science Component (see general requirement 6)	3
Total	**32**

Bachelor of Science
Major in Applied Mathematics

Minimum required: 129-130 semester hours

General Requirements:

1. At least 32 hours are required in mathematics and must include MATH 2471, 2472, 3305, 3323, 3373, 3377, and 12 semester hours from MATH 3348, 3375, 3398, 4305, 4306, or 4336.
2. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
3. 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.
4. A fourth semester of English, ENG 3303, is required for this degree.
5. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	Hours
COMM 1310	3
CS 1428	4
MATH 2471, 2472	8
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
PFW two courses	2
Minor	3
Total	**33**

Sophomore Year	Hours
CS 2308	3
ENG Literature (see general requirement 5)	3
MATH 3323, 3373	6
ENG 3303	3
Electives (see general requirement 2)	9
PHIL 1305	3
Minor	6
Total	**33**

Junior Year	Hours	Senior Year	Hours
ART, MU, DAN or TH 2313	3	Electives (see general requirement 2)	17
MATH 3305, 3377	6	Advanced MATH courses	6
Advanced MATH courses	6	Social Science Component (see general requirement 5)	3
Elective (see general requirement 2)	3	Minor	6
POSI 2310, 2320	6		
Natural Science Component (see general requirement 5)	7-8		
Total	**31-32**	**Total**	**32**

Minor in Mathematics

A minor in mathematics requires at least 17 hours, including MATH 2471, 2472 and at least three courses above the 3000 and below the 5000 level other than MATH 3315, 4302, 4304, 4311, and 4382.

Courses in Mathematics (MATH)

1300 Pre-College Algebra. (1-3) A course to remediate and review basic academic skills in mathematics, including number concepts, computation, elementary algebra, geometry and mathematical reasoning. MATH 1300 will not constitute a part of the hours required for a bachelor's degree.

1311 Basic Mathematics. (1-3) 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 school with no more than the minimum mathematics requirements or for students who have been away from mathematics for a number of years. Prerequisite: MATH 1300 with a grade of "CR", Mathematics ACT score of at least 15 (SAT 320 or SAT re-centered 400), or a mathematics placement score of at least 14. MATH 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 re-centered 480), a mathematics placement score of at least 26, or MATH 1311 with a grade of "C" or higher or "CR".

1316 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 re-centered 480), a mathematics placement score of at least 26, or MATH 1311 with a grade of "C" or higher 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. Prerequisite: MATH 1315 with a grade of "C" or higher.

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 re-centered 480), a mathematics placement score of at least 26, or MATH 1311 with a grade of "C" or higher 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: MATH 1315 or 1319 with a grade of "C" or higher.

2311 (MATH 1350) 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: MATH 1315 with a grade of "C" or higher.

2312 (MATH 1351) Informal Geometry. (3-0) Geometric measuring. Euclidean Geometry, and topics associated with informal geometry, including historical, philosophical, and cultural significance. Prerequisite: MATH 2311 with a grade of "C" or higher.

2321 (MATH 2313) Calculus 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: Mathematics ACT score of at least 24 (SAT 500 or SAT re-centered 520) or MATH 1315 with a grade of "C" or higher.

2328 (MATH 2342) Elementary Statistics. (3-0) Algebra-based introduction to descriptive statistics, random sampling, design of experiments, probability and the Central Limit Theorem. Inferential statistics topics include the foundational concepts for confidence intervals and hypothesis testing for simple experiments. Prerequisite: MATH 1315 with a grade of "C" or higher.

2331 Calculus for Life Science II. (3-0) Extension of MATH 2321. Topics will include: trigonometric functions, probability, integral calculus, differential equations, and applications. Prerequisite: MATH 2321 with a grade of "C" or higher.

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

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

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: Mathematics ACT score of at least 26 (SAT 540 or SAT re-centered 560) or MATH 2363 or 2417 with a grade of "C" or higher.

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: MATH 2471 with a grade of "C" or higher.

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: MATH 2472 with a grade of "C" or higher.

3315 Modern Geometry. (3-0) Modern geometry with an emphasis on the triangle, circle, plane and Euclidian geometry, an historical aspects will be integrated into the course. May not be applied toward a minor in mathematics. Prerequisites: MATH 2321 or 2471 with a grade of "C" or higher.

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: MATH 2472 with a grade of "C" or higher.

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 or Co-requisite: MATH 2471.

3330 Introduction to Advanced Mathematics. (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: MATH 2471 with a grade of “C” or higher.

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. Prerequisite: MATH 1315 with a grade of “C” or higher.

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: MATH 2472 with a grade of “C” or higher.

3375 Engineering Mechanics. (3-0) A course covering statistics, using a vector approach to mechanics. The course is designed to satisfy the requirements of engineering Colleges. Prerequisite: PHYS 1430. Prerequisite or Co-requisite: MATH 2472.

3377 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: MATH 2472 with a grade of “C” or higher.

3380 Analysis I. (3-0) A course covering the introduction to the theory of real functions. Topics include limits, continuity and derivatives and associated topics. Prerequisite: MATH 3330 with a grade of “C” or higher.

3398 Discrete Mathematics II. (3-0) A continuation of discrete Mathematics I. Prerequisite: MATH 2358 with a grade of “C” or higher.

4302 Principles of Mathematics II. (3-0) Topics such as modeling, measurement, statistics, probability, geometry and algebra concepts will be integrated with sound middle school pedagogical practices such as inquiry learning, use of manipulatives, problem-based learning, calculator use, co-operative learning, and peer presentations. Prerequisite: MATH 2311 with a grade of "C" or higher.

4304 Math Understandings. (3-0) Basic concepts underlying algebra, geometry, trigonometry, and calculus taught from an advanced standpoint, including historical, philosophical, and cultural significance. May not be applied toward a minor in mathematics. Must be taken before student teaching. Prerequisite: MATH 3315 and 2331 or 2472 with grades of “C” or higher.

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: MATH 3305 with a grade of “C” or higher.

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: MATH 3323 with a grade of “C” or higher.

4307 Modern Algebra. (3-0) A course covering elementary set theory, structures, functions, and concepts of modern algebra. Prerequisites: MATH 3330 with a grade of “C” or higher and MATH 3325 or 3377 with a grade of “C” or higher.

(WI) **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. May not be applied toward a minor in mathematics. Prerequisite: MATH 3315 with a grade of “C” or higher and MATH 2331 or 2472 with a grade of “C” or higher.

4315 Analysis II. (3-0) A continuation of MATH 3380. Topics include integration, series and sequences of functions and associated topics. Prerequisite: MATH 3380 with a grade of “C” or higher.

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: MATH 3330 or 3380 with a grade of “C” or higher.

4336 Studies 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. May be repeated once for credit with a different topic. Prerequisite: Consent of instructor.

(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. May not be applied toward a minor in mathematics. Prerequisites: A grade of "C" or higher in two of these three: MATH 3380, 4307, or 4330.

Department of Physics

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Fax: (512) 245-8233 Web: http://www.physics.txstate.edu/

Degree Programs Offered

- BA, major in Physics
- BS, major in Physics

Minor Offered

- Physics

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.

The BS with a major in Physics provides a rigorous background in physics as a preparation for graduate studies or a career in industry. The BA with a major in Physics 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.

Students who enter Texas State needing mathematics at a level below MATH 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

General Requirements:

1. The major requires at least 41 semester hours which include: PHYS 1430, 2425, 2435, 3312, 3320, 3411, 3414, 4310, 4312, 4315 and at least two additional advanced courses chosen from: PHYS 3315, 3416, 3417, 4311, or 4340 or courses approved by the department advisor.
2. Students should consult the department advisor or the College of Science Advising Center before choosing a minor.
3. BIO 1430 and 1431 may be taken instead of CHEM 1141, 1341 and 1142, 1342 listed in the sophomore year below.
4. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
5. 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.
6. See University College section for general education core curriculum requirements.

Freshman Year	Hours	Sophomore Year	Hours
ENG 1310, 1320	6	CHEM 1141, 1341, 1142, 1342 (see general requirement 3)	8
US 1100	1	Electives/Minor (see general requirements 2 and 4)	4
HIST 1310, 1320	6	ENG 3303	3
MATH 2471, 2472	8	ENG Literature (see general requirement 6)	3
PFW two courses	2	MATH 3323, 3373	6
PHYS 1430	4	PHIL 1305	3
COMM 1310	3	PHYS 2425, 2435	8
Total	**30**	**Total**	**35**

Junior Year	Hours
ART, DAN, MU, or TH 2313	3
Electives/Minor (see general requirements 2 and 4)	11
MATH 3323	3
PHYS 3312, 3320, 3411, 3414	14
POSI 2310, 2320	6
Total	**37**

Senior Year	Hours
Minor/Electives (see general requirements 2 and 4)	11-13
PHYS electives (see general requirement 1)	6
PHYS 4310, 4312, 4315	9
Social Science Component (see general requirement 6)	3
Total	**26-31**

Bachelor of Arts
Major in Physics

Minimum required: 128 semester hours

General Requirements:

1. The major requires 28 hours which include PHYS 1430, 2425, 2435, 3312, and 3411, and 9 additional hours of advanced physics courses selected from PHYS 3315, 3416, 3417, 3320, 3414, 4310, 4311, 4312, 4315, or 4340.
2. Majors should consult the department advisor or the College of Science Advising Center before choosing a minor.
3. A minimum of 9 writing intensive hours and a total of 39 advanced hours are required to graduate. An advanced course is one that is numbered above 3000 and below 5000.
4. BIO 1430 and 1431 may be taken instead of CHEM 1141, 1341 and 1142, 1342 listed in the sophomore year below.
5. See the University College section of this catalog for general education core curriculum requirements.

Freshman Year	Hours
ENG 1310, 1320	6
US 1100	1
HIST 1310, 1320	6
MATH 2471	4
PHIL 1305	3
PFW two courses	2
PHYS 1430	4
COMM 1310	3
Total	**29**

Sophomore Year	Hours
CHEM 1141, 1341, 1142, 1342 (see general requirement 4)	8
ENG Literature (see general requirement 5)	3
MATH 2472, 3373	7
PHYS 2425, 2435	8
POSI 2310, 2320	6
Total	**32**

Junior Year	Hours
ART, DAN, MU, or TH 2313	3
Electives/Minor (see general requirements 2 and 4)	8
Modern Language 1410, 1420	8
PHYS 3411, 3312	7
Social Science Component (see general requirement 5)	3
ENG 3303	3
Total	**32**

Senior Year	Hours
Electives/Minor (see general requirements 2 and 4)	20
Modern Language 2310, 2320	6
PHYS advanced electives (see general requirement 1)	9
Total	**35**

Teacher Certification

Currently, there are six Texas Grades 8-12 science certifications: Computer Science, Life Sciences, Mathematics, Physical Sciences, Science, and Technology. Students seeking any of these certifications need to follow coursework leading to a degree in the appropriate science field, in addition to taking the required certification courses prescribed in the College of Science section. Initial or additional certification may also be acquired as a post-baccalaureate

or graduate student. Students interested in certification are strongly encouraged to see the Science Advisor early in their undergraduate program or certification process.

Minor in Physics

A minor in physics requires PHYS 1430, 2425, 2435, and 3312, and at least six hours of advanced physics.

Courses in Physics (PHYS)

1110 (PHYS 1105) Elementary Physics Laboratory. (0-2) This course explores and illustrates some of the basic principles covered in PHYS 1310 and 1320. This lab should be taken as you take the second of the two courses, PHYS 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 PHYS 1340 or 1350 for those students desiring a laboratory 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 (PHYS 1110). PHYS 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.

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). PHYS 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.

1340 (PHYS 1312) 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 1311) 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.

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. PHYS 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. Prerequisite: MATH 1315 with a grade of “C” or higher. MATH 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. PHYS 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. Prerequisites: PHYS 1410; MATH 1315 with a grade of “C” or higher. MATH 1317 is recommended.

1430 (PHYS 2425) Mechanics. (3-3) This course covers the principles of classical mechanics through problem solving and laboratory investigations. PHYS 1430, 2425, and

2435 are designed for students majoring in physics and for pre-engineering students. Credit for both PHYS 1410 and 1430 cannot be given. Co-requisite: MATH 2471.

2425 (PHYS 2426) Electricity and Magnetism. (3-3) A study of the field of electricity and magnetism for physics majors and minors. PHYS 1430, 2425, and 2435 are designed for those students majoring or minoring in physics and for pre-engineering students. Credit in both PHYS 1420 and 2425 cannot be given. Prerequisite: PHYS 1430. Co-requisite MATH 2472.

2435 (PHYS 2427) Waves and Heat. (3-3) A study of the fields of wave motion, sound, light and heat at a beginning level for physics majors and minors. Prerequisites: MATH 2472 and PHYS 2425.

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: PHYS 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. Prerequisite: PHYS 2435. Co-requisite: PHYS 3411.

3315 Thermodynamics. (3-0) The fundamental study of thermodynamics and statistical mechanics. Prerequisites: PHYS 2435 or 1420; MATH 3323.

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: MATH 3373. Co-requisite: MATH 3323.

(WI) **3411 Advanced Physics Laboratory.** (2-6) Experiments in modern physics, with emphasis on demonstrating quantum effects and introducing nuclear physics. Co-requisite: PHYS 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. Prerequisite: PHYS 2435.

3416 Applied Electronics. (3-4) 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, OpAmps, and analog/digital ICs. The behavior of the circuits will be modeled in SPice. Elementary semiconductor device physics and microfabrication methods will be discussed. Prerequisite: PHYS 2435.

3417 Optics. (3-3) A one-semester survey of geometrical and physical optics accompanied by laboratory experience. Topics covered include electromagnetic waves and their propagation, geometrical optics, polarization, interference, diffraction, Fourier optics, and holography. Prerequisite: PHYS 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, magneto static energy, and magnetic properties of matter. Prerequisites: MATH 3323 and 3373; PHYS 3320 (or equivalent preparation with consent of the instructor).

4311 Condensed Matter Physics. (3-0) Application of physics principles to solid materials. Topics include crystal structure and the reciprocal lattice, including x-ray diffraction, crystal binding and elastic properties, lattice vibrations, energy bands, semiconductors and metals. Prerequisite: PHYS 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: MATH 3323; PHYS 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: PHYS 4310.

4317 Computational Physics. (3-3) Introduction to computational techniques for problem-solving and research beyond the standard techniques of most physics courses. Numerical, symbolic, and simulation methods applied to modern physics using advanced mathematical software and a high-level programming language. Prerequisites: PHYS 3320 and six additional hours of advanced physics or instructor consent.

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. May be repeated once with different emphasis and professor for additional credit. Prerequisite: Consent of the instructor.

4321 Undergraduate Research. (0-9) A research project in physics to be carried out under the supervision of a faculty member by upper division physics majors. Student must contact a faculty member in advance to arrange topic and specific course objective. Course may be repeated only as an elective towards the BS or BA in physics. Prerequisite: Instructor approval.

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: PHYS 3416, 3411, and 4311.

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