COLLEGE OF SCIENCES AND MATHEMATICS

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VISION
Empower the next generation of science, technology, engineering and mathematics professionals to lead and serve in a changing world.

MISSION
Through excellent teaching, research and other scholarly activities, the SFA College of Sciences and Mathematics provides high-quality undergraduate and graduate programs in a nurturing environment that prepare students for leadership and service as STEM professionals.

CORE VALUES
Excellence, innovation, professionalism, life-long learning, engagement and integrity

ADVISING AND STUDENT SERVICES
Students are advised either in the College of Sciences and Mathematics Academic Advising and Student Services Center or by their assigned faculty advisor. In consultation with their advisor, students select courses each semester that enable them to complete all requirements for their academic major or minor as well as all other requirements for the baccalaureate degree. All students in the College of Sciences and Mathematics have an advising hold every semester that can be cleared only by the advisor following the advising session. After completing at least 45 hours of coursework, students must file a tentative degree plan in the Academic Advising and Student Services Center, located in room 127 of the Miller Science Building.

SCHOLARSHIPS
The College of Sciences and Mathematics and its academic units annually award numerous scholarships to students majoring in the college. These scholarships are available to undergraduates, including incoming freshmen and transfer students, as well as graduate students. Scholarships are awarded based on academic excellence and/or financial need. Applications are due by Feb. 1 and are accessible online through the Office of Student Financial Assistance

website. More specific information about scholarships is available by referencing department websites or sections of this bulletin or by contacting the college office at (936) 468-2805. Information about other sources of financial aid also is available from the Office of Student Financial Assistance.

UNDERGRADUATE TAKING GRADUATE WORK FOR CREDIT
See the Graduate Bulletin, Admission section, Overlap Program Admission, or the Overlap Program in the Academic Programs and Policies section of this bulletin.

CHOICE OF MAJOR PROGRAM IN SCIENCES AND MATHEMATICS
By the time students have earned 45 semester hours of coursework, they must have selected a major program and prepared an outline of degree requirements with assistance from the Academic Advising and Student Services Center in the College of Sciences and Mathematics and their departmental advisor. In order to be accepted as a major in this college, a student must have attained a minimum C average for all work taken in the intended major department.

COLLEGE MINORS
With the exception of the School of Nursing, all academic units within the college offer minors. In addition, the college offers two interdisciplinary minors.

The human health perspectives minor is a 22-hour program emphasizing basic science and mathematics that can be used in conjunction with any major and is an ideal choice for students pursuing careers in the health care industry. Students choosing this minor must complete:
- CHE 111(4) or 133(4)
- BIO 238(4), 239(4) and 308(4)
- MTH 220 and
- NUR 304.

The combined sciences minor provides students with the option of a minor across the sciences. This minor consists of 22-23 hours of coursework that must be from an area outside the major and must be approved by the dean of the College of Sciences and Mathematics. This coursework must include:
- Two sequences from CHE 133(4) and 134(4), GOL 131(4) and 132(4), PHY 131(4) and 132(4), BIO 131(4) and 133(4), or CSC 102(3), 202(3) and 241(3); and
- Six advanced hours from CHE, GOL, PHY, BIO, CSC or AST, which must be a subset of courses that are applicable to the science major.

CERTIFICATION FOR HIGH SCHOOL SCIENCE AND MATHEMATICS TEACHING
The minimum requirements for science and mathematics teaching fields for candidates for high school certificates are outlined in the Teacher Certification section of this bulletin.

PROCEDURES FOR REINSTATEMENT OF STUDENTS ON SUSPENSION
Students in the College of Sciences and Mathematics whose academic record is such that they are placed on suspension should contact the Academic Advising and Student Services Center as soon as possible after having received grades with a notice of suspension. The College of Sciences and Mathematics will adhere to the university policy for reinstatement, as explained under the heading Academic Programs and Policies of this bulletin.

DEGREE REQUIREMENTS

Bachelor of Science

Biology, Biochemistry, Chemistry, Engineering Physics, Geology, Mathematics, Physics

1. Core Curriculum Requirements (42 hours)
- A. Communication (6 hours)
  - Three hours from: ENG 131, 133H
  - Three hours from: COM 111, 170, 215
- B. Mathematics (3 hours): Three hours from: MTH 233
- C. Life and Physical Sciences (6 hours) (Lab required)
  - Six hours from: AST 105; BIO 131, 133, 225, 238; CHE 133, 134; GOL 131, 132; PHY 110, 131, 132, 241, 242
- D. Language, Philosophy and Culture (3 hours)
  - Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H; HIS 151, 152; PHI 153, 223
- E. Creative Arts (3 hours)
  - Three hours from: ART 280, 281, 282; DAN 140; MHL 245; MUS 140; THR 161, 163
- F. American History (6 hours): Six hours: HIS 133, 134
- G. Government/Political Science (6 hours): Six hours: PSC 141, 142
- H. Social and Behavioral Sciences (3 hours)
  - Three hours from: ANT 231; ECO 231, 232; GEO 131; PSY 133; SOC 137
- I. Component Area Option (6 hours)
  - Three hours: ENG 132
  - Three hours from: BCM 247; ENG 273: FRE 131, 132: GER 131, 132; POR 131, 132; SPA 131, 132: SPH 172, 272

2. College Requirements
- Three or four hours from: MTH 220, 234, depending on requirements of major.
- Six to eight hours from: *BIO 131, *133, 225, *238; *CHE 133, *134; GOL 131, 132, *PHY 110, *131, *132, *241, *242; *AST 105. The natural science courses used to satisfy 1-C above and this requirement must have at least two different sciences represented.
- Three hours from: CSC 101, 102, 121

An asterisk before a course number indicates that the appropriate laboratory course must be taken in conjunction with the lecture course.

3. Additional Requirements
- Each discipline may restrict course selections from the core in order to satisfy degree requirements in that discipline. These restricted choices will be found in the degree plan for each discipline.
- Only three hours of mathematics and six hours of science are included in the core. Programs requiring four credit hour mathematics or science courses incorporate the additional hours elsewhere in their program requirements.
- An academic major of at least 30 specified semester hours is required for all departments. At least 12 of the 15 advanced semester hours must be in residence at SFA.
- A minimum of 42 semester hours of work in residence at SFA, at least 36 hours of which must be advanced (courses numbered 300-499 inclusive).
- Enough additional hours to make a total of at least 120 semester hours, including those in any minor that may be required by a department.

- A grade of at least C in each freshman English course, a C average at SFA and a C average in all specified work completed in the major and minor fields, considered separately, at SFA. These required averages are based on courses in each category included in the student's official degree plan.

Bachelor of Science in Nursing
1. Core Curriculum Requirements (42 hours)
  A. Communication (6 hours)
   - Three hours from: ENG 131, 133H
   - Three hours from: COM 111, 170
  B. Mathematics (3 hours): Three hours: MTH 220
  C. Life and Physical Sciences (6 hours): Six hours from: BIO 238, CHE 111
  D. Language, Philosophy and Culture (3 hours)
   - Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H; HIS 151, 152; PHI 153, 223
  E. Creative Arts (3 hours)
   - Three hours from: ART 280, 281, 282; DAN 140; MHL 245; MUS 140; THR 161, 163
  F. American History (6 hours): Six hours: HIS 133, 134
  G. Government/Political Science (6 hours): Six hours: PSC 141, 142
  H. Social and Behavioral Sciences (3 hours): Three hours: PSY 133
  I. Component Area Option (6 hours)
   - Three hours: ENG 132
   - Three hours from: BCM 247; ENG 273: FRE 131, 132: GER 131, 132; POR 131, 132; SPA 131, 132: SPH 172, 272

2. Additional Requirements
  A. Academic courses required by the School of Nursing must include BIO 238L (A&P I Lab); CHE 111L (Introduction to Chemistry Lab); BIO 239 and 239L (A&P II and Lab); BIO 308 (Pre-nursing Microbiology); three or four hours from PSY 376, HMS 336, or HMS 236/236L (Child Development); NUR 304 (Pathophysiology); three hours from PSY 133 (General Psychology); three hours from HMS 239 or 355 (Nutrition); three hours from CSC 101 (Introduction to Computing) or CSC 121 (Introduction to Information Processing Systems); and three hours from SOC 137 (Introduction to Sociology), SOC 139 (Race and Ethnic Relations) or ANT 231 (Cultural Anthropology). In addition, three hours of nursing electives are required prior to graduation.
  B. A nursing major of at least 51 to 55 hours.
  C. Enough additional hours to make a total of at least 120 semester hours of acceptable credit.
  D. A minimum of 42 hours of residence work (on SFA campus), at least 36 semester hours of which must be advanced (300-400 level).
  E. A grade of at least C in each freshman English course, a C average in coursework completed at SFA, minimum of C in each course in the major field and specified cognates. These required averages are based upon those courses in each category included in the student's official degree plan.

Degree requirements are subject to changes approved by the Board of Regents during the previous academic year. Check with your department regarding changes in the major.

Bachelor of Arts
Information Technology
1. Core Curriculum Requirements (42 hours)
A. Communication (6 hours)
- Three hours from: ENG 131, 133H
- Three hours from: COM 111, 170, 215 (COM 111 recommended)

B. Mathematics (3 hours): Three hours: MTH 220

C. Life and Physical Sciences (6 hours)
- Six hours from: AST 105; BIO 121, 123, 131, 133, 225, 238; CHE 111, 133, 134; ENV 110; GOL 131, 132; PHY 101, 102, 110, 131 or 241, 132 or 242 (PHY 110 is recommended as one course)

Note: Most science courses require co-enrollment in an appropriate laboratory course (see College Requirements).

D. Language, Philosophy and Culture (3 hours)
- Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H; HIS 151, 152; PHI 153, 223

E. Creative Arts (3 hours)
- Three hours from: ART 280, 281, 282; DAN 140; MHL 245; MUS 140; THR 161, 163

F. American History (6 hours): Six hours: HIS 133, 134

G. Government/Political Science (6 hours): Six hours: PSC 141, 142

H. Social and Behavioral Sciences (3 hours)
- Three hours from: ANT 231; ECO 231, 232; GEO 131; PSY 133; SOC 137 (ECO 231 or 232 is recommended)

I. Component Area Option (6 hours)
- Three hours: ENG 132
- Three hours from: BCM 247; ENG 273; FRE 131, 132; GER 131, 132; POR 131, 132; SPA 131, 132: SPH 172, 272 (either BCM 247 or ENG 273 recommended)

2. College Requirements (Some of these courses may be taken to satisfy part of the Core Curriculum Requirements listed in Item 1. Fourteen to fifteen additional hours.)
A. MTH 220 plus three to four hours from: MTH 133, 138, 139, 140, 143, 144, 233

B. BLW 335 or GBU 325

C. Two additional courses (at least six hours) must be taken from the College of Liberal and Applied Arts and/or the College of Fine Arts.

D. Two hours from appropriate laboratory courses for core science courses

3. Major Requirements (34 hours)
A. CSC 101 or 121, 102, 201, 211

B. Twelve hours from: CSC 340, 350, 351, 353, 355

C. Three hours from: CSC 452, 455

D. CSC 411 (one hour)

E. Six advanced hours of computer science (a maximum of three hours may be used from CSC 385 and 412).

A student must have a grade of C or higher in all courses that are prerequisite to a computer science course before enrolling in that course.

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4. Minor (18-23 hours) or Second Major (at least 24 hours) Requirements:
  A. An academic minor of at least 18 semester hours, but not more than 23 semester hours, with at least nine advanced hours and at least six advanced hours at SFA
  B. A second major of at least 24 semester hours with at least 12 advanced hours at SFA

5. Hours Requirements:
  • Only three hours of mathematics and six hours of science are included in the core. Programs requiring four credit hour mathematics or science courses incorporate the additional hours elsewhere in their program requirements.
  • At least 42 hours in residence at SFA, at least 36 advanced hours in residence at SFA and at least 12 hours of advanced work in the major at SFA. At least six advanced hours in the minor at SFA or at least 12 advanced hours in the second major at SFA. At least 120 semester hours total (excluding remedial-type courses).

6. Grade Requirements:
  *Maintain at least a 2.0 GPA in courses completed at SFA and a grade of at least C in each freshman English course. Maintain at least a 2.0 GPA in major coursework at SFA, in minor/second major coursework at SFA and in advanced computer science courses at SFA.

***Note:** Required averages are based on those courses in each category that are included in the student's official degree plan.*

7. Additional Requirements:
  A. If the approximate equivalent of a required upper-division course is taken at another accredited institution at the freshman-sophomore level and transferred to SFA, the transferred course will be accepted for elective credit only, and an appropriate junior-senior level course in the same field will be substituted for the required course.
  B. All students must satisfy provisions of the Texas Success Initiative program. See TSI information elsewhere in this bulletin.

Bachelor of Science

Computer Information Systems
1. Core Curriculum Requirements (42 hours)
  A. Communication (6 hours)
    • Three hours from: ENG 131, 133H
    • Three hours: COM 111
  B. Mathematics (3 hours): Three hours: MTH 220
  C. Life and Physical Sciences (6 hours)
    • Six hours from: AST 105; BIO 121, 123, 131, 133, 225, 238; CHE 111, 133, 134; ENV 110; GOL 131, 132; PHY 101, 102, 110, 131 or 241, 132 or 242

Note: Most science courses require co-enrollment in an appropriate laboratory course (see College Requirements).
  D. Language, Philosophy and Culture (3 hours)
    •Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H; HIS 151, 152; PHI 153, 223
  E. Creative Arts (3 hours)
    • Three hours from: ART 280, 281, 282; DAN 140; MHL 245; MUS 140; THR 161, 163

F. American History (6 hours): Six hours: HIS 133, 134

G. Government/Political Science (6 hours): Six hours: PSC 141, 142

H. Social and Behavioral Sciences (3 hours): Three hours: ECO 232

I. Component Area Option (6 hours)
   • Three hours: ENG 132
   • Three hours: ENG 273

2. College Requirements (Some of these courses may be taken to satisfy part of the Core Curriculum Requirements listed in Item 1. Seventeen additional hours.)

A. MTH 138 or 143, 144, 220

B. COM 111; ENG 273

C. ECO 232, 339

D. ACC 232

E. MKT 351

F. Two hours from appropriate laboratory courses for core science courses.

3. Major Requirements: (34 hours):

CSC 102, 202, 211, 214, 241, 321, 323, 411 (one hour), 426, plus nine advanced hours of computer science, excluding CSC 340, 350, 351, 353, 355, 385, 412, 452 and 455. A student must have a grade of C or higher in all courses that are prerequisite to a computer science course before enrolling in that course.

4. Minor Requirements

ACC 231; BLW 335; ECO 231; FIN 333; FIN 369 or GBU 147; GBU 325; MGT 370

5. Hours Requirements:
   • Only three hours of mathematics and six hours of science are included in the core. Programs requiring four credit hour mathematics or science courses incorporate the additional hours elsewhere in their program requirements.
   • At least 42 hours in residence at SFA; at least 36 advanced hours in residence at SFA and at least 12 hours of advanced work in the major at SFA. At least six advanced hours in the minor at SFA. At least 120 semester hours total (excluding remedial-type courses).

6. Grade Requirements:
   *Maintain at least a 2.0 GPA in courses completed at SFA and a grade of at least C in each freshman English course. Maintain at least a 2.0 GPA in major coursework at SFA, in minor coursework at SFA, and in advanced computer science courses at SFA.
   Note: Required averages are based on those courses in each category that are included in the student's official degree plan.

7. Additional Requirements:
   A. If the approximate equivalent of a required upper-division course is taken at another accredited institution at the freshman-sophomore level and transferred to SFA, the transferred course will be accepted for elective credit only, and an appropriate junior-senior level course in the same field will be substituted for the required course.

   B. All students must satisfy provisions of the Texas Success Initiative program. See TSI information elsewhere in this bulletin.

Sciences and Mathematics

Bachelor of Science

Computer Science

1. Core Curriculum Requirements (42 hours)
  A. Communication (6 hours)
    • Three hours from: ENG 131, 133H
    • Three hours: COM 111
  B. Mathematics (3 hours): Three hours: MTH 220
  C. Life and Physical Sciences (6 hours)
    • Six hours from: AST 105; BIO 131, 133, 225, 238; CHE 133, 134; GOL
      131, 132; PHY 110, 131 or 241, 132 or 242

Note: Most science courses require co-enrollment in an appropriate laboratory course (see College Requirements).

  D. Language, Philosophy and Culture (3 hours)
    • Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H;
      HIS 151, 152; PHI 153, 223
  E. Creative Arts (3 hours)
    • Three hours from: ART 280, 281, 282; DAN 140; MHL 245; MUS 140;
      THR 161, 163
  F. American History (6 hours): Six hours: HIS 133, 134
  G. Government/Political Science (6 hours): Six hours: PSC 141, 142
  H. Social and Behavioral Sciences (3 hours)
    • Three hours: ANT 231; ECO 231, 232; GEO 131; PSY 133; SOC 137
  I. Component Area Option (6 hours)
    • Three hours: ENG 132
    • Three hours: ENG 273

2. College Requirements (Some of these courses may be taken to satisfy part of the Core Curriculum Requirements listed in Item 1. Twenty-one to 22 additional hours):
  A. COM 111, ENG 273
  B. MTH 139 or 140, 220, 233, 234
  C. Four semesters (14-16 hours) of laboratory sciences, including appropriate laboratory courses chosen from: AST 105; BIO 131, 133, 225, 238; CHE 133, 134; EGR 111, 112; GOL 131, 132; PHY 110, 131 or 241, 132 or 242; any laboratory science course in biology, chemistry, geology or physics requiring one of the above science courses as a prerequisite. One natural science area must contain a two-semester course sequence. (PHY 110 is recommended as one course).

Note: Most science courses require co-enrollment in an appropriate laboratory course.

3. Major Requirements: (43 hours)
  CSC 102, 202, 211, 214, 241, 321 or 331, 323, 333, 341, 342, 411 (one hour); six hours from: CSC 425, 435, 442, 447; plus six advanced hours of computer science, excluding CSC 340, 350, 351, 353, 355, 385, 412, 452, 455. A student must have a grade of C or higher in all courses that are prerequisite to a computer science course before enrolling in that course.

4. Hours Requirements:
  • Only three hours of mathematics and six hours of science are included in the core. Programs requiring four credit hour mathematics or science courses incorporate the additional hours elsewhere in their program requirements.
  • At least 42 hours in residence at SFA, at least 36 advanced hours in residence at SFA, at least 15 hours of advanced work in the major at SFA,

and at least 120 semester hours total (excluding remedial-type courses).

5. **Grade Requirements:**
   *Maintain at least a 2.0 GPA in courses completed at SFA and a grade of at least C in each freshman English course. Maintain at least a 2.0 GPA in major coursework at SFA, minor coursework at SFA, in advanced computer science courses at SFA and in transfer courses.

   ***Note:** *Required averages are based on those courses in each category that are included in the student's official degree plan.*

6. **Additional Requirements:**
   A. If the approximate equivalent of a required upper-division course is taken at another accredited institution at the freshman-sophomore level and transferred to SFA, the transferred course will be accepted for elective credit only, and an appropriate junior-senior level course in the same field will be substituted for the required course.
   B. All students must satisfy provisions of the Texas Success Initiative program. See TSI information elsewhere in this bulletin.

Sciences and Mathematics

DEPARTMENT OF BIOLOGY

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AREAS OF STUDY AND DEGREE

B.S. Biology
Degree Tracks:
• Botany
• Cellular and Molecular Biology
• Ecology and Evolutionary Biology

FACULTY

Professors
  D. Brent Burt, Beatrice Clack, Stephen J. Mullin, Donald B. Pratt, Josephine Taylor, Alexandra Van Kley, James E. Van Kley, Stephen C. Wagner, Robert J. Wiggers

Associate Professors
  Sarah C. Canterberry, Dennis A. Gravatt, Matthew Kwiatkowski, J. Kevin Langford

Assistant Professors
  Daniel J. Bennett, Jennifer M. Gumm, Rebecca D. Parr

Lecturer
  Vance Imhoff

Lab Coordinators
  Erin M. Childress, Joann Giudici, Ronald Havner, Gene A. Sullivan, Justin B. Sullivan

OBJECTIVES

The biology department's mission is to produce broadly trained biologists with the skills and knowledge that will prepare them to succeed in the biological field of their choosing. The academic programs offered have the intellectual breadth and academic rigor needed to achieve this objective. The Department of Biology has established three goals to meet the mission:

1. Graduates will possess a fundamental knowledge of living organisms.
2. Graduates will possess critical-thinking skills and be able to apply the scientific method to solve problems.
3. Graduates will appreciate and be able to describe the role that advances in biology play in our society.

STUDENT ORGANIZATIONS

• Biology Club
• Botany Interest Group
• Tri-Beta (Biological Honor Society)
• Alpha Epsilon Delta (Pre-health Honor Society)
• American Medical Student Association

DEFINITION OF THE MAJOR

Students wishing to choose a major in biology should consult with members of the department faculty early in their university career. Because the department includes a number of biological disciplines, no single curriculum can be listed for all majors. All students majoring in biology are required to take a 20 credit hour life science core consisting of BIO 125, 130, 131, 133, 341 and 470. See below for a detailed explanation under the heading Biology Major Requirements. Each student is strongly encouraged to work closely with a

departmental advisor to design the program best suited to the interests and goals of the student.

While completing a common core of courses taken by all majors, students must select from the following degree tracks: botany, cell and molecular biology or ecology and evolutionary biology. The list of required courses within each degree track is listed under the heading Degree Tracks.

A minimum of 40 semester hours of biology, including the core curriculum, with 15 hours in advanced courses is required for a B.S. with a major in biology. Biology majors also must satisfy all the requirements of the B.S. for the College of Sciences and Mathematics outlined earlier in the bulletin.
Students who major in biology must complete the following requirements:
- Three hours from: ENG 273
- Six hours from: MTH 220, 233, 234
- Eight hours from: CHE 133, 134
- Six to eight hours from: CHE 231, 331, 332; GOL 131, 132; PHY 131, 132
- Biology majors contemplating graduate work are advised to complete MTH 233, CHE 331, 332 and PHY 131 and 132.

Each student also is required to complete a minor of 18 to 24 semester hours in a single discipline. At least six hours in the minor must be in advanced-level courses at SFA. Biology majors may choose a combined-sciences minor consisting of CHE 133, 134; eight hours from GOL 131, 132 or PHY 131, 132; plus six advanced hours from CHE, GOL or PHY. Biology majors contemplating graduate work are advised to elect a minor in a selected science or in mathematics.

DEFINITION OF THE MINOR (20-23 HOURS)
A biology minor may be earned by taking 20-23 hours of biology. All those seeking a minor must successfully complete (a C or better) BIO 130, 131 and 133. The minor may be completed by taking three additional upper-division biology courses. All general and specific course prerequisites are applicable. The following courses may not be used to complete a minor: BIO 121, 123, 238, 239, 301, 308. Additionally, only three hours of BIO 300 may be counted toward the minor.

CERTIFICATION FOR HIGH SCHOOL LIFE SCIENCES TEACHING
Requirements for certification are listed in the Educator Certification section of this bulletin. A summary of the biology course requirements for certification is listed below under the emphasis Educator Certification.

BIOLOGY MAJOR REQUIREMENTS: B.S. DEGREE
Core Requirements (20 hours)
Every biology major will complete a biology core consisting of BIO 125, 130, 131, 133, 341 and 470.

Degree Tracks (minimum 20 hours each)
In addition to the core, biology majors are required to select from one of the degree tracks listed below. BIO 300, 471, and 472 also may fulfill requirements for a degree track if the topic is deemed appropriate by the instructor and the department chair. Consult with a faculty advisor for assistance. Remember, a minimum of 40 semester hours (15 of which are advanced) of biology is required to complete the major.

(I). Botany

Required:

1. Three to four hours of Physiology/Anatomy: 401 or 404
2. Three hours of Plant Diversity: 351 or 435
3. Three hours of Mycology or Plant Pathology: 312 or 424
4. Advanced Elective: three hours from 313, 370, 402, 403 or 431
5. Biology Electives: six to eight hours; selected in consultation with an advisor

(II). Cellular and Molecular Biology

Required:

1. Three to four hours of Physiology: 327 or 404
2. Three to four hours of Organismal Biology: 309, 342, or 401
3. Three hours from: Cell and Molecular: 402 or 431
4. Biology Electives: nine-11 hours; selected in consultation with an advisor

(III). Ecology and Evolutionary Biology

Required:

1. Six hours of ecology and evolution: 313 and 370
2. One course of advanced ecology: 403, 407, 412, 414, 450, 471*, or 472*
3. One course of advanced evolution: 471** or 472**
4. One course of organismal biology: 225, 309, 312, 327, 342, 343, 350, 351, 353, 401, 403, 404, 424, 430, 433, 435, 436, 437 or 438
5. Biology Elective***: One additional advanced ecology, advanced evolution or advanced organismal or 475

* Bio 471/472 Special Topics in Biology (ecology topics) as advised.

** Bio 471/472 Special Topics in Biology (evolution topics) as advised.

*** A particular Biology course can be used to fill only one of the core requirements.

TEACHER CERTIFICATION

Refer to the Educator Certification portion of this bulletin in the College of Education section for specific professional teacher education coursework requirements.

Freshman Year (32-34 hours)

BIO 130 or 131, 131L		BIO 130 or 131, 131L	
or 133, 133L	3-4 hrs	or 133,133L	3-4 hrs
Freshman English	3 hrs	Freshman English	3 hrs
CHE 133, 133L	4 hrs	CHE 134, 134L	4 hrs
MTH 138	3 hrs	MTH 133	3 hrs
Elective	3 hrs	Elective	3 hrs
	16-17*hrs		16-17* hrs

Upon approval of the advisor, certain courses required for the B.S. degree outlined for the College of Sciences and Mathematics earlier in this bulletin may be substituted for one or more of the courses shown above.

THE GRADUATE MAJOR AND MINOR

The biology department offers a graduate program for students who plan to work toward the master's degree. For detailed information concerning the graduate major and minor programs in the biology department, refer to the Graduate Bulletin.

GENERAL COURSE PREREQUISITES

A minimum grade of C is required in all courses that are prerequisites to a biology course. Students must be TSI complete or exempt to enroll in BIO 125, 130, 131, 133, 238 and 239.

COURSES IN BIOLOGY (BIO)

Unless otherwise indicated, courses listed below are three semester hours credit (three hours lecture) per week.

121. **Concepts of Biology** - Three semester hours, three hours lecture per week. Concepts-oriented course for the non-science major. Study of the origin of life, the cell, growth and reproduction, genetics and evolution. May not be used to meet graduation requirements by students majoring in the College of Sciences and Mathematics or for certain certification of high school teachers in biology. Required lab fee.

121L. **Concepts of Biology Lab** - One semester hour, two hours laboratory per week. Concepts-oriented course for the non-science major. Study of the origin of life, the cell, growth and reproduction, genetics, and evolution. May not be used to meet graduation requirements by students majoring in the College of Sciences and Mathematics or for certification of high school teachers in biology. Required lab fee. Co-requisite: BIO121L.

123. **Human Biology** - Three semester hours, three hours lecture per week. Biological principles for non-science majors. Study of the evolution of man, organ systems and the human organism. May not be used to meet graduation requirements of students majoring in the College of Sciences and Mathematics or for certification of high school teachers in biology. Co-requisite BIO 123L.

123L. **Human Biology Lab** - One semester hour, two hours laboratory per week. Hands-on experiments in human anatomy and physiology, cell structure, genetics, evolution, and ecology. May not be used to meet graduation requirements of students majoring in the College of Sciences and Mathematics or for certification of high school teachers in biology. Required lab fee. Co-requisite: BIO123.

125. **Principles of Ecology and Evolution** - Three semester hours, three hours lecture per week, two hours laboratory per week. Fundamental principles of biological inquiry, scientific analysis, and concepts in ecological and evolutionary biology. Lab fee required.

125L. **Introduction to Ecology and Evolution Lab** - One semester hour, two hours laboratory per week. Fundamental principles of biological inquiry, scientific analysis, and concepts in ecological and evolutionary biology. Required lab fee. Co-requisite: BIO 125.

130. **Principles of Cell and Molecular Biology** - Three semester hours, three hours lecture per week. An introductory cell biology course. Topics include the structure of the cell and cell components, both eukaryotic and prokaryotic. The processes of DNA replication and gene expression, including protein processing and routing. Photosynthesis, respiration and chemotrophy as means of energy production. The cell cycle and its regulation. Successful completion of CHE 133 and 133L recommended prior to enrolling in this course.

131. **Principles of Botany (BIOL 1411)** - Three semester hours, three hours lecture per week. Topics include the study of plant form, function and reproduction, and an overview of plant diversity, including bryophytes, ferns and seed plants. Co-requisite: BIO 131L.

131L. **Principles of Botany Lab (BIOL 1411)** - One semester hour, two hours laboratory per week. Introduction to the fundamental principles of botany and the plant sciences. Topics include the study of plant form, function, reproduction, and an overview of plant diversity including bryophytes, ferns, and seed plants. Required lab fee. Co-requisite: BIO 131.

133. **Principles of Zoology (BIOL 1413)** - Three semester hours, three hours lecture per week. Fundamental principles of animal life, including invertebrate and vertebrate animals. Co-requisite: BIO 133.

133L. **Principles of Zoology Lab (BIOL 1413)** - One semester hour, two hours laboratory per week. Fundamental principles of animal life, including invertebrate and vertebrate animals. Required lab fee. Co-requisite: BIO 133.

220. **Medical Terminology** - Three semester hours, three hours lecture per week. Covers the specialized medical terms used in the health care professions, providing explanations of terms, clinical procedures and abbreviations. Prerequisites: BIO 130, 133 or 238.

225. **Local Flora/Fauna** - Three semester hours, two hours lecture, three hours lab per week. Field studies of local plants, animals or fungi and their habitats. Different offerings of the course will emphasize different organismal groups, e.g. plants, birds, reptiles, amphibians, arthropods, mammals, fish, or fungi. Required field trips, travel and lab fees.

238. **Human Anatomy and Physiology I (BIOL 2401)** - Three semester hours, three hours lecture per week. Structure and function of the skeletal, muscular and nervous systems. Not open to students who have received credit for BIO 327. Not open for credit for biology majors or minors. Co-requisite: BIO 238L.

238L. **Human Anatomy and Physiology I Lab (BIOL 2401)** - One semester hour, three hours lab per week. Structure and function of the skeletal, muscular and nervous systems. Not open to students who have received credit for BIO 327. Not open for credit for biology majors or minors. Required lab fee. Co-requisite: BIO 238.

239. **Human Anatomy and Physiology II (BIOL 2402)** - Four semester hours, three hours lecture, three hours lab per week. Structure and function of the circulatory, respiratory, digestive, excretory, endocrine and reproductive systems. Not open to students who have received credit for BIO 327. Not recommended for biology majors or minors. Prerequisite: successful completion of BIO 238. Required lab fee.

275. **Special Problems** - Individual study and/or laboratory research conducted under the supervision of a biology faculty member. Variable credit one to three hours. May be repeated for a maximum of three credit hours toward a degree plan.

300. **Contemporary Biology** - Three semester hours, three hours lecture per week. Survey of biological principles and their application to the

contemporary newsworthy problems as they apply to the biological future of man. Variable topics, such as recent advances of medicine, the population explosion, world food problems, environmental pollution, genetic engineering, epidemics and natural disasters. Maximum of six hours for biology major.

301. Biology for Teachers (Gr. 4-8) - Four semester hours, three hours lecture, two hours laboratory per week. This course provides instruction in the main areas of biological science for which science teachers (Grades 4-8) are expected to demonstrate competency for teacher certification. Students seeking certification in Early Childhood – Grade 6 Generalist also are encouraged to enroll. Topics include basic principles of science, structure and function of living things, reproduction and heredity, adaptation and evolution, regulatory mechanisms and behaviour, and organisms and environment. This course may not be used to meet graduation requirements by a student majoring/minoring in the College of Sciences and Mathematics. Lab Fee Required.

302. Cancer Biology - Three semester hours, three hours lecture. Survey of topics relevant to the biology of cancer, including cancer epidemiology, viral causes of cancer, the genes and metabolic pathways behind cancer development, the role of DNA damage in cancer, events leading to metastasis and methods of treating cancer, including the development of targeted therapies. Prerequisite: BIO 130 or 131 or 133 or permission of the instructor.

304. Marine Biology - Three semester hours, three hours lecture per week. This course introduces all main aspects of marine environments, including properties of seawater, ocean currents, classification of marine environments, structure and functioning of aquatic communities, as well as the impact of the habitat destruction and nuisance invasive species on the biodiversity and productivity of marine ecosystems. Prerequisites: BIO 131 and 133.

308. Pre-nursing Microbiology - Four semester hours, three hours lecture, four hours laboratory per week. Nursing majors will study the nature of micro-organisms and their ability to interact with humans. Students also will learn current techniques used to identify, culture, and control micro-organisms. Does not meet degree requirements for biology major. Prerequisites: One semester of biology and one semester of chemistry. Lab fee required. BIO 238 and 239, and CHE 111 or 133 with lab.

309. Microbiology - Four semester hours, three hours lecture, four hours lab per week. Morphology, physiology, genetics and classification of micro-organisms, with relationship to man. Required lab fee. Prerequisites: BIO 130, 131, 133 and CHE 133.

312. Mycology - Three semester hours, two hours lecture, three hours lab per week. Structure, classification and identification of fungi, including those of economic importance. Required lab fee. Prerequisites: BIO 131 and 133.

313. General Ecology - Three semester hours, two hours lecture, three hours lab per week. Principles of ecology with special reference to populations and their ecosystems, distribution, biotic communities and environmental relationships. Required field trips, travel and lab fees.

Prerequisites: BIO 131, 133 and MTH 138.

327. Human Physiology - Three semester hours, three hours lecture per week. Functions of the major systems of the body. Not open to students who have received credit for BIO 238. Prerequisites: BIO 130 and 133.

341. Genetics - Four semester hours, three hours lecture, three hours lab per week. An introduction to modern genetic principles, including inheritance patterns, chromosomes structure and function, gene expression and regulation, DNA replication and repair and the behavior of genes in populations. Required lab fee. Prerequisites: BIO 130, 131, 133; CHE 133, 134.

342. Comparative Vertebrate Zoology - Four semester hours, three hours lecture, six hours lab per week. Anatomical study of the vertebrates with major emphasis on comparisons of organ systems. Vertebrate relationships, origins and adaptations. Representative forms in the laboratory. Prerequisite: BIO 133 or equivalent. Required lab fee.

343. General Entomology - Three semester hours, two hours lecture, three hours lab per week. Basic principles of insect life. Anatomy, physiology, life cycles, classification, ecology and control methods. Required lab fee. Prerequisites: BIO 131 and 133, or permission of instructor.

345. Vertebrate Embryology - Four semester hours, two hours lecture, six hours lab per week. Animal development. Laboratory studies of frog, chick and pig embryos with reference to human development. Prerequisite: BIO 241. Required lab fee.

350. Economic Botany - Three semester hours, three lecture hours per week. Fundamental concepts and processes involving plants. Examination of the diversity of plants and their role in the biosphere. The relationship and importance of plants to humans. Recommended for biology and non-biology majors.

351. Plant Kingdom - Four semester hours, three hours lecture, three hours lab per week. Comparative study of organisms traditionally classified in the plant kingdom, including algae, bryophytes, ferns, and allies and seed plants. The course will highlight evolutionary trends in reproductive morphology and adaptations to a desiccating environment. Required lab fee. Prerequisite: BIO 131.

353. Economic Entomology - Four semester hours, three hours lecture, three hour's lab per week. Study of destructive and beneficial insects. Emphasis on recognition and control. Required lab fee. Prerequisites: BIO 131, 133 or permission of the instructor.

370. Evolution - Three semester hours, three hours lecture per week. Basic principles, mechanism and patterns of evolution, including a historical survey of related ideas. Prerequisite: BIO 341.

401. Plant Anatomy - Three semester hours, two hours lecture, three hours lab per week. Study of plant cells, tissues, tissue systems and development of seed plant stems, roots and leaves. Required lab fee. Prerequisite: BIO 130 and 131 or permission of the instructor.

402. Cellular Biology - Three semester hours, three hours lecture per week. Structure and function of eukaryotic cells. Topics include architecture

of the cell and function of cellular components; the cytoskeleton; interactions between the cell and the extra cellular matrix; regulation of cell growth, differentiation and division; and mechanisms of cellular transport. Prerequisite: BIO 341.

403. Terrestrial Plant Ecology - Three semester hours, two hours lecture, three hours lab per week. This course introduces students to basic ecological concepts from both the perspective of plant communities (synecology) and of populations or individual species (autecology). Additionally, the course introduces students to current vegetation sampling methodology and to the analysis of multivariate vegetation data. Required lab and travel fees. Prerequisites: BIO 130, 131 and 133.

404. Plant Physiology - Four semester hours, three hours lecture, three hours lab per week. Survey of the principal physiological processes of higher plants, including water relations, respiration, photosynthesis and mineral nutrition. Required lab fee. Prerequisites: BIO 130, 131 and CHE 133, 134.

407. Behavioral Ecology - Three semester hours, three hours lecture per week. The study of how animal behaviors influence survival and reproduction of individuals in different ecological settings. The course will examine the ecological context in which behaviors evolve and will consist of lectures and class discussions of assigned readings of important behavioral studies. Prerequisite: BIO 313 or FOR 209.

408. Pathogenic Bacteriology - Four semester hours, three hours lecture, three hours lab per week. Basic survey of medically important bacteria. Includes mechanisms of pathogenesis, collection and transport of specimens, initial specimen processing, and identification of isolates by classical, automated and molecular techniques. Prerequisite: BIO 309. Required lab fee.

410. Fundamentals of Immunology - Four semester hours, three hours lecture, three hours lab per week. Basic survey of the immune system with focus on the human and mouse models. Covers the origin and differentiation of the hematopoietic system; antibody structure and function; and basic serologic techniques such as ELISA, fluorescence microscopy, agglutination, precipitation and gel diffusion. Prerequisites: BIO 309 and 341. Required lab fee.

411. Phylogenetics - Three semester hours, three hours lecture per week. Examination of the methods used to reconstruct and evaluate the strength of evolutionary trees (phylogenies). The methods used to test evolutionary hypotheses using these evolutionary trees also will be examined. Additionally, the course will examine the logic and assumptions associated with each methodological approach. Outside readings and participation in class discussions will be required. Prerequisites: BIO 130, 131, 133, 341, 370 or permission of instructor.

412. Field Biology - Six semester hours, five-week summer session. Quantitative studies of ecological communities. Analysis of biodiversity and ecological relationships through participation in field research projects. Possible topics include population, community ecosystem, and evolutionary and/or behavioral ecology. A maximum of six credits of 412 or 414 may be applied to the biology major. An additional six credits

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may be used toward advanced electives. Transportation expenses will be required. Lab fee required. Prerequisites: 18 hours of biology, biology major or minor and permission of the instructor.

414. **Field Course in Applied Ecological Methods** - Six semester hours, five-week summer session. Research projects will involve methods and instrumentation for documenting ecological patterns. Students will learn to collect and analyze data using the newest and/or most widely accepted tools available. A maximum of six credits of 412 or 414 may be applied to the biology major. An additional six credits may be used toward advanced electives. Transportation expenses will be required. Lab fee required. Prerequisites: 18 hours of biology, biology major or minor and permission of the instructor.

415. **Principles of Electron Microscopy** - Four semester hours, two hours lecture, six hours lab per week. Introduction to the biological applications of transmission and scanning electron microscopy. Required lab fee. Prerequisites: senior standing with a major or minor in the sciences and permission of the instructor.

420. **Virology** - Four semester hours, three hours lecture, three hours lab per week. Basic study of viruses with laboratory. Covers viral structure, genome organization, replication strategies and medical implications of infection. Laboratory includes bacteriophages, animal and plant viral propagation, basic tissue culture, PCR for viral detection, and fluorescence and electron microscopy for viral identification. Prerequisites: BIO 309 and 341. Required lab fee.

424. **Plant Pathology** - Three semester hours, two hours lecture, three hours lab per week. Principles of plant pathology. Survey of fungal, bacterial and viral diseases of plants. Required lab fee. Prerequisites: BIO 131 and junior or senior standing (60 or more credit hours completed).

430. **Invertebrate Natural History** - Three semester hours, two hours lecture, three hours lab per week. Animals without backbones. Laboratory emphasis on recognition. Brief study of insects and parasites. Prerequisites: BIO 131 and 133. Required lab fee.

431. **Molecular Biology** - Three semester hours, three hours lecture per week. Structure, function and organization of DNA, DNA replication, transcription and translation of RNA. Mechanisms of gene expression and regulation. Prerequisite: BIO 341.

433. **Ornithology** - Four semester hours, three hours lecture, three hours lab per week. Classification, distribution, ecology and evolution of birds. Emphasis on identification of local species in lab. Field trips, travel and lab fees required. Prerequisite: BIO 133 or permission of the instructor.

435. **Plant Systematics** - Three semester hours, two hours lecture, three hours lab per week. Diversity of plants, their identification, naming, classification and evolution. Required field trips, travel and lab fees. Prerequisites: BIO 131 and BIO 130 or 133.

436. **Mammalogy** - Four semester hours, three hours lecture, three hours lab per week. Classification, evolution, natural history and distribution of mammals. Emphasis on natural history and identification of regional

species in lab. Field trips required. Requires outside readings and/or research projects. Travel and lab fees required. Prerequisite: BIO 133 or permission of the instructor.

437. Herpetology - Four semester hours, three hours lecture, three hours lab per week. Classification, distribution, ecology and evolution of amphibians and reptiles. Emphasis on natural history and identification of regional species in lab. Field trips required. Requires outside readings, papers and/or research projects. Travel and lab fees required. Prerequisite: BIO 133 or permission of instructor.

438. Ichthyology - Three semester hours, two hours lecture, three hours lab per week. Classification, evolution, natural history and distribution of freshwater fishes. Required field trips. Prerequisite: BIO 133 or permission of the instructor. Required travel and lab fees.

439. Parasitology - Four semester hours, three hours lecture, three hours lab per week. Basic survey of parasites, primarily from the human pathogen perspective. Includes identification and pathogenesis of protozoan, nematode and cestode parasites. Coverage of taxonomic identification of preserved and fresh clinical samples in lab. Prerequisite: BIO 309. Required lab fee.

442. Molecular Genetics of Human Disease - Three semester hours, three hours lecture per week. A detailed survey of genetic disease mechanisms involving case studies of specific genetic disorders. An examination of specific genes and the effects of mutations upon protein structure and chemistry and upon the physiology of those affected. Prerequisite: BIO 341.

445. Developmental Biology - Three semester hours, three hours lecture per week. Fundamental mechanisms of embryonic development. Molecular, cellular and tissue interactions that direct development of vertebrate and invertebrate embryos. Prerequisite BIO 342.

448. Bioinformatics - Three semester hours, three hours lecture per week. This course is offered to any student interested in combining computer applications with the life sciences. An introduction to database management, data mining, DNA sequence analysis and alignment, PERL, and LINUX will be described. Prerequisite: BIO 341.

449. Histology - Four semester hours, two hours lecture, six hours lab per week. Microscopic structure of vertebrate tissues and cells, with consideration of their origin and function in the adult body. Prerequisite: BIO 342. Offered in fall only. Required lab fee.

450. Limnology - Four semester hours, three hours lecture, three hours lab per week. Study of the biological, chemical and physical characteristics of the freshwater environment. Required field trips. Prerequisites: BIO 131 and 133. Required travel and lab fees.

470. Seminar in Biology - One semester hour, one-hour lecture per week. For undergraduate credit only. Student participation in general and specific topics in biology; separate section for life sciences teacher certification. May be repeated once on a different topic for credit. Prerequisite: 30 hours in biology.

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471.	**Special Topics in Biology** - Three semester hours, three hours lecture per week. For undergraduate credit only. Special studies in the biological sciences. May be repeated in a different topic. Prerequisite: four semesters of biology.

472.	**Special Topics in Biology** - Three semester hours, two hours lecture, three hours lab per week. Special studies in the biological sciences. May be repeated in a different topic. Prerequisite: four semesters of biology. Laboratory must be taken concurrently with the lecture.

475.	**Special Problems** - Variable one to three semester hours. For undergraduate credit only. Independent investigations by students guided through individual conferences with a professor. May be repeated for a maximum of six semester hours toward degree plan. Prerequisites: 18 hours of biology with minimum B average and approval of the department chair.

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY

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AREAS OF STUDY AND DEGREES

B.S. Biochemistry
Pre-professional Programs:
- Dentistry
- Medicine
- Optometry
- Pharmacy
- Veterinary Medicine

B.S. Chemistry
Major Concentrations:
- Biochemistry/Pre-medical
- Interdisciplinary
- Professional Chemist
- Secondary Education

Minor:
Chemistry

FACULTY

Professors
Michele R. Harris, Michael A. Janusa, Kefa K. Onchoke

Associate Professors
Alyx S. Frantzen, Darrell R. Fry, Odutayo O. Odunuga

Assistant Professors
Brian M. Barngrover, Russell J. Franks, Brannon Gary, Jenny Han, Matibur R. Zamadar

Lecturer
Catherine Kwiatkowski

OBJECTIVES

The objectives of the Department of Chemistry and Biochemistry are:

- to prepare students for graduate and/or professional schools (e.g., medical)

- to prepare students for positions in industry, government service and teaching

- to allow science students with non-chemistry majors to relate chemistry to their major science

- to acquaint non-science students with the methods, concepts and achievements of the science of chemistry.

The chemistry curriculum has the full approval of the American Chemical Society for training professional chemists.

- **Biochemistr**y - curriculum designed for students interested in biochemistry-related careers or life/health sciences (i.e. medical), which includes pre-medical and other pre-professional students. Biochemistry combines the fundamentals of chemistry with advanced courses in biochemistry and the life sciences. Biochemistry students are required to minor in biology (21 hours).

- **Interdisciplinary** - curriculum designed for students interested in learning chemical sciences; however, other options may be designed with approval of the department. Although chemistry is a distinct subject or discipline of inquiry, chemistry contributes to all the other science disciplines and is interdisciplinary by nature. It is for this reason this concentration allows students the flexibility to supplement a core study of chemistry with courses in other science fields. The curriculum provides students the intellectual tools to integrate their concentration areas, engage in interdisciplinary problem-solving, and prepares them for careers and/or graduate programs that increasingly cross disciplinary boundaries. Graduates are prepared for entry into the job market or graduate study in the sciences or an interdisciplinary area, or in medical, law, and business schools. Interdisciplinary concentration students are required to have 25 hours of approved minor/concentration courses.

- **Professional Chemist** - curriculum designed for students who wish to pursue graduate education for a career in research in chemistry or in a chemical industry. The curriculum specifically includes advanced coursework in all five sub-disciplines of chemistry (analytical, biochemistry, organic, inorganic and physical). Students selecting the professional chemist concentration are free to choose any minor; however, the combined science minor is highly recommended.

- **Secondary Education** - curriculum designed for students whose career goals are in the secondary education field. Secondary education students are required to minor in secondary education (24 hours).

STUDENT ORGANIZATION
Chemistry Club

DEFINITION OF MAJOR AND MINOR
A minimum of 120 semester hours of coursework is required for a B.S. Of these hours, 19 core chemistry hours are required, including CHE 133, 134, 231, 275, 331, 470 and 475. Each major concentration has additional hours of required courses; these hours are classified as major (31 hrs) and minor/concentration (18 hrs) under the Suggested Curriculum Sequence section. General education courses, CSC elective, PHY 131/241 and 132/242, MTH 233 and MTH elective also are required. A maximum of four hours of CHE 475/476 may be counted toward the major.

A minor in chemistry consists of a minimum of 18 hours of chemistry coursework. The hours for a minor must include CHE 133, 134, 231, 331 and two advanced hours in chemistry. A maximum of two semester hours of CHE 475/476 can be counted for a minor.

CHE 111, 112, 125, 302, 320 and 330 cannot be counted as hours of chemistry for a major or minor in chemistry.

AMERICAN CHEMICAL SOCIETY-CERTIFIED BACHELOR OF SCIENCE
An American Chemical Society-certified B.S. in chemistry consists of completing the professional chemist track and completion of a satisfactory supervised research project (CHE 475 or 476). To obtain a certified degree, additional courses beyond their curricula are required for the biochemistry major,

interdisciplinary and secondary education concentrations.

CERTIFICATION FOR CHEMISTRY OR PHYSICAL SCIENCE TEACHING (Grades 8-12)
Students who wish to qualify for teaching certificates should consult the Teacher Certification section of this bulletin.

GRADUATE STUDY IN CHEMISTRY
The Overlap Graduate Degree Program permits qualified undergraduates to pursue a limited amount of graduate study (usually 12 credit hours or less) concurrently with undergraduate study. The Department of Chemistry and Biochemistry offers a thesis and non-thesis natural science master's degree (thesis option highly recommended). Thesis master's degree requires a minimum 24 of the required 30 semester hours in chemistry (including CHE 589 and 590). The non-thesis master's degree requires a minimum 18 of the required 36 semester hours in chemistry.

The department also offers an overlap graduate degree program that permits qualified undergraduates to pursue a limited amount of graduate study (usually 12 credit hours or less) concurrently with their undergraduate study giving a student the opportunity to obtain a B.S. and M.S. in only five years of study.

For more information and eligibility requirements, consult the Graduate Bulletin or the Overlap Program in the Academic Programs and Policies section of this bulletin.

SUGGESTED CURRICULUM SEQUENCE FOR BACHELOR OF SCIENCE
(Suggested Sequence)
The department offers a Bachelor of Science that requires all students to complete a major track and minor (or second major), take the appropriate core curriculum requirements and have the required semester hours for graduation.

Freshman Year (32 hours)

CHE 133/133L	4	CHE 134/134L	4
CSC elective*	3	Social & Behavioral Sc:	3
ENG 131 or 133	3	ENG 132	3
HIS 133 or 134	3	HIS 133 or 134	3
Minor/Conc.***	3	Minor/Conc.***	3
TOTALS	**16**		**16**

Sophomore Year (31 hours)

CHE 275	1	CHE 475	1
Major***	3	CHE 231	4
CHE 331/331L	4	Major***	4
ENG 273	3	Lang., Phil., Culture	3
MTH 233**	4	MTH elective*	3-4
TOTALS	**15**		**15-16**

Junior Year (31 hours)

Major***	4	Creative Arts	3
Major***	4	Major***	3
PHY elective I*	4	Oral Communication	6
Minor/Conc.***	3	PHY elective II*	4
		Minor/Conc.***	3

TOTALS	15		16

Senior Year (26 hours)

Advanced Minor/Conc.***	3	Advanced Minor/Conc.***	3
PSC 141	3	PSC 142	3
Major***	4	CHE 470	1
Major***	3	Major***	6
TOTALS	**13**		**13**

***Biochemistry** - Major: BIO electives (three hours; used to satisfy BIO minor); CHE 332, 337, 443, 452/452L, 453, 454, 464; advanced electives or MTH 220 (three hours).

Minor: BIO minor (18 hours plus three major hours). Required biology courses: BIO 130 (3), 131 (4), 133 (4); recommend remaining biology courses from the following: 309 (4), 327 (3), 341 (4), 342 (4), 402 (3), 431 (3).

*CSC elective: 101, 102 or 121

*MTH elective: MTH 234

*PHY elective I and II: PHY 131/132 or 241/242

Courses needed prior to MCAT/DAT (students typically take MCAT/DAT spring of junior year): BIO 130,131, 133, 327, 341, 342, 449; CHE 133, 134, 331, 332, 452; PHY 131, 132.

Interdisciplinary - Major (31 hours): advanced chemistry electives (15 hours from CHE 332, 337, 338, 420, 441, 442L, 443, 452, 452L, 453, 454, 455, 464, 475, 476, 480, 481); advanced electives (nine hours); remaining hours used to satisfy interdisciplinary concentration requirements (seven hours).

Concentration (25 hours - 18 minor/concentration hours plus seven hours from 31 major hours): hours approved by department; however, department suggests two sequences from BIO 131/133, GOL 131/ 132, CSC 102/202/241 and nine hours of advanced electives from AST, BIO, CSC, GOL or PHY. Exclusions: courses that do not meet graduation requirements for majors or minors in the college.

*CSC elective: 101, 102 or 121 (note: 102 is required for CSC sequence)

*MTH elective: MTH 220 or 234 (note: MTH 220 may require an additional elective hour to satisfy 120-hour requirement)

*PHY elective I and II: PHY 131/132 or 241/242

Professional Chemist - Major: CHE 241, 332, 337, 338, 441/442L, 443, 452/452L, advanced electives (four hours)

Minor: any minor (18 hours)

*CSC elective: 101, 102 or 121

*MTH elective: MTH 234

*PHY elective I and II: PHY 241/242

Secondary Education - Major: SED required courses (six hours), CHE 241, 332, 337, 443, 452/452L, 481, HMS 203

Minor: Secondary education minor (18 hours). Required secondary education courses: SED 370 (3), 371 (3), 372 (3), 442 (6), 443 (3), 450 (3), 460 (3)

*CSC elective: 101, 102 or 121

*MTH elective: MTH 234

*PHY elective I and II: PHY 131/132 or 241/242

**MTH 233 is the entry-level course for this major. All prerequisites for MTH 233 must be met.

CO-REQUISITE COURSES
Courses that are co-requisites must be taken together during the same semester. Separate grades will be awarded for these courses. Withdrawal from one co-requisite course requires the dropping of the other course. A student is not required to repeat a co-requisite course for which the student has received a passing grade of C.

COURSE CREDIT
A minimum grade of C is required in all courses that are prerequisites to a chemistry course. Unless otherwise indicated, courses are three-semester hours credit, three hours lecture per week.

COURSES IN CHEMISTRY (CHE)
100. Preparation for General Chemistry - Designed for the students whose marginal background in chemistry would not allow them to succeed in CHE 133. Review of basic math and chemistry principles for students deficient or insecure in these areas. Topics covered will include, but will not be limited to, scientific calculations, atomic structure and the periodic table, gas laws, and reaction stoichiometry. Recommended for all students who wish to enroll in CHE 133, but who do not meet the prerequisites or did not have high school chemistry. Note this course does not meet any requirements for any degree.

101. Conceptual Chemistry - Three semester hours, two hours of lecture and three hours of lab per week. CHE 101 is an overview of the field of chemistry and its impact on science, technology, society and the environment. This conceptual approach involves a minimum of mathematics and investigates the chemistry found in the world around us, especially environmental issues. This course utilizes an integrated lecture/lab format and does not count toward a major or minor in chemistry. Lab fee required.

111. Introductory Chemistry I (CHEM 1305) - Introduction to the principles and concepts of chemical thought. Co-requisite: CHE 111L. Prerequisite: eligibility for MTH 138.

111L. Introductory Laboratory I (CHEM 1105) - One semester hour, two hours lab per week. Introductory laboratory experiments. Co-requisite: CHE 111. Lab fee required.

112. Introductory Chemistry II (CHEM 1307) - Elementary organic and biochemical systems. Prerequisites: CHE 111 and 111L. Co-requisite: CHE 112L.

112L. Introductory Laboratory II (CHEM 1107) - One semester hour, two hours lab per week. Introductory organic laboratory experiments. Prerequisites: CHE 111 and 111L. Co-requisite: CHE 112. Lab fee required.

133. **General Chemistry I (CHEM 1311)** - Atomic and molecular structures, stoichiometry, gas laws and thermodynamics. Co-requisite: CHE 133L. Prerequisite: MTH 138 or MTH 143 or minimum math score of 25 on ACT or 580 on SAT.

133L. **General Laboratory I (CHEM 1111)** - One semester hour, three hours laboratory per week. Spectroscopy, quantitative experiments. Co-requisite: CHE 133. Lab fee required.

134. **General Chemistry II (CHEM 1312)** - Equilibrium, kinetics, redox, descriptive chemistry and radiochemistry. Prerequisites: CHE 133, 133L and MTH 138. Co-requisite: CHE 134L.

134L. **General Laboratory II (CHEM 1112)** - One semester hour, three hours laboratory per week. Kinetics, spectrophotometry, quantitative/qualitative experiments. Prerequisites: CHE 133 and 133L. Co-requisite: CHE 134. Lab fee required.

231. **Quantitative Analysis** - Four semester hours, three hours lecture, three hours lab per week. Analytical applications of solution chemistry. Prerequisites: CHE 134 and 134L. Lab fee required.

241. **Inorganic Chemistry** - Fundamental concepts of the descriptive inorganic chemistry of the elements. Prerequisites: CHE 134 and 134L.

271. **Special Topics in Chemistry** - Special studies in chemistry. May be repeated once on a different topic. Prerequisite: permission of the instructor.

271L. **Special Topics Lab** - One semester hour, three hours laboratory per week. Special studies in chemistry laboratory techniques. May be repeated once on a different topic. Prerequisite: permission of the instructor. Required lab fee.

275. **Supervised Problems** - One to four semester hours. Individual study and/or laboratory research. Prerequisite: permission of instructor. Pass or fail grading.

276. **Supervised Problems** - One to four semester hours. Continuation of CHE 275. Individual study and/or laboratory research. Prerequisite: permission of instructor. Pass or fail grading.

302. **Fundamental Applications of Chemistry** - Four semester hours, three hours lecture, two hours lab per week. Presentation of the applications of chemistry and chemical principles to everyday life with an emphasis on hands-on investigations. May not be used to meet graduation requirements by a student majoring/minoring in the College of Sciences and Mathematics. Required lab fee.

320. **Chemical Concepts** - Review of fundamentals of chemistry as related to teaching. Does not count toward a major or minor in chemistry. Prerequisite: eight hours of chemistry.

321. **Applied Chemical Concepts** - Fundamentals of laboratory safety and stockroom management/design. Prerequisite: CHE 231.

330. **Fundamentals of Organic Chemistry** - Comprehensive one semester course for students requiring only one semester of organic. Prerequisites: CHE 134 and 134L. Co-requisite: CHE 330L.

330L. **Fundamentals of Organic Lab** - One semester hour, three hours of lab per

week. Synthesis and characterization of organic compounds. Prerequisites: CHE 134 and 134L. Co-requisite: CHE 330. Required lab fee.

331. **Organic Chemistry I** - Development of organic chemistry for chemistry majors, minors and pre-health professionals. Prerequisites: CHE 134 and 134L. Co-requisite: CHE 331L.

331L. **Organic Laboratory I** - One semester hour, four hours of lab per week. Synthesis and characterization of organic compounds. Prerequisites: CHE 134 and 134L. Co-requisite: CHE 331. Required lab fee.

332. **Organic Chemistry II** - Continuation of CHE 331. Prerequisites: CHE 331 and 331L. Co-requisite: CHE 332L.

332L. **Organic Laboratory II** - One semester hour, four hours lab per week. Continuation of 331L. Prerequisites: CHE 331 and 331L. Co-requisite: CHE 332. Required lab fee.

337. **Physical Chemistry I** - Four semester hours, three hours lecture, three hours lab per week. Laws, principles and theories concerning the structure of matter as related to properties. Prerequisites: CHE 231 and 475 and MTH 234. Required lab fee.

338. **Physical Chemistry II** - Four semester hours, three hours lecture, three hours lab per week. Continuation of CHE 337. Prerequisite: CHE 337. Required lab fee.

420. **Environmental Chemistry** - Four semester hours, three hours lecture, three hours lab per week. Chemical processes involved in the environment. Prerequisites: CHE 231 and 330 or 331. Required lab fee.

441. **Advanced Inorganic Chemistry** - Reactions and structures of inorganic molecules and ions are studied. Prerequisite: CHE 337.

442L. **Advanced Inorganic Chemistry Laboratory** - One semester hour, three hours laboratory per week. The preparation and characterization of inorganic compounds. Prerequisite: CHE 441 or concurrent enrollment. Lab fee required.

443. **Instrumental Analysis** - Four semester hours, three hours lecture, three hours lab per week. Spectrochemical and electrochemical methods of analysis. Prerequisites: 231 and 337. Required lab fee.

452. **Comprehensive Biochemistry I** - Essentials of biochemistry relating to amino acids, proteins, DNA, lipids, carbohydrates, as well as an overview of major metabolic pathways. Prerequisite: CHE 330 or 331.

452L. **Comprehensive Biochemistry I Laboratory** - One semester hour, three hours of lab per week. Purification and characterization of biomolecules. Prerequisites: CHE 330L or 331L and CHE 452 or concurrent enrolment. Required lab fee.

453. **Comprehensive Biochemistry II** - In-depth study of proteins, enzymes, biochemical applications of kinetics and thermodynamics, and advanced metabolic pathways. Prerequisite: CHE 452.

454. **Biochemical Techniques** - Three semester hours, one hour lecture, six hours lab per week. A capstone course for the biochemistry major that allows the student to obtain practice in biochemical techniques. Prerequisites: CHE 452L and CHE 464. Lab fee required.

Sciences and Mathematics

455. **Advanced Organic Chemistry** - Continuation of CHE 331-332, emphasizing spectroscopic methods and advanced topics. Prerequisite: CHE 332.

464. **Advanced Biochemistry** - In-depth study of the biochemistry of regulation of gene expression, signal transduction and biochemical computational applications. Prerequisite: CHE 453.

470. **Seminar** - One semester hour. Written and oral reports. Individual instruction. May be repeated for a total of four credit hours. Prerequisite: CHE 337.

471. **Advanced Special Topics** - One to four semester hours. Special studies in chemistry. May be repeated once on a different topic. Prerequisite: permission of the instructor.

471L. **Advanced Special Topics Lab** - One semester hour, three hours laboratory per week. Special studies in chemistry laboratory techniques. May be repeated once on a different topic. Prerequisite: permission of the instructor. Lab fee required.

475. **Advanced Supervised Problems** - One to four semester hours. May be repeated for a total of four hours credit. Undergraduate only. Individual study and/or laboratory research. Prerequisites: CHE 275 and consent of the instructor. Pass or fail grading.

476. **Advanced Supervised Problems** - One to four semester hours. May be repeated for a total of four hours credit. Undergraduates only. Individual study and/or laboratory research. Prerequisite: consent of the instructor. Pass or fail grading.

480. **Industrial Internship** - Practical work in an industrial setting for a minimum of eight weeks under the joint guidance of a practicing chemist and SFA faculty member. May be repeated for credit if content differs. Prerequisite: permission of the department chair and instructor. Pass or fail grading.

481. **Laboratory Internship** - Three semester hours, one hour lecture, four hours lab per week. Teaching experience in undergraduate chemistry laboratory, including maintenance, laboratory preparation, grading and assistance of students in laboratory experience under the direct supervision of faculty mentor. May be repeated for credit if content differs. Prerequisite: permission of the department chair and instructor. Pass or fail grading.

DEPARTMENT OF COMPUTER SCIENCE

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AREAS OF STUDY AND DEGREES

B.S. Computer Science
B.S. Computer Information Systems
B.A. Information Technology

MINORS:

Computer Science
Computer Information Systems
Information Technology

FACULTY

Professors
David A. Cook , Deborah L. Dunn
Assistant Professors
Dae J. Glendowne, Christopher P. Ivancic, Pushkar V. Ogale
Visiting Assistant Professor
Puntitra Sawadpong
Instructor
William W. Long
Lecturers
Anne Marie Eubanks, Elizabeth A. Hutchison, Korey E. Kahler

OBJECTIVES

The digital computer is one of the most useful devices developed by mankind. Computer science is the discipline concerned with the study of this device and how it can be used to process information and help solve complex problems. The computer science curriculum is designed to allow the future computer specialist to obtain a broad education coupled with detailed knowledge in computer science sufficient to lay a foundation for professional competence in the computing field. Non-specialists may also take computer science courses that will acquaint them with computing capabilities applicable to their main field of endeavor.

COMPUTER SCIENCE PROGRAM ACCREDITATION

The Bachelor of Science program with a major in computer science is accredited by the Computing Accreditation Commission of ABET Inc., abet.org.

PROGRAM EDUCATIONAL OBJECTIVES - B.S. in computer science

1. Graduates possess a broad-based, general education and an indepth understanding of computer science sufficient to provide a foundation for professional competence and advanced study in the computing field.

2. Graduates have sufficient knowledge, skills and insights to make important contributions in the computing field.

3. Graduates can think critically, communicate effectively and learn independently in the workplace or in graduate school.

Sciences and Mathematics

STUDENT ORGANIZATIONS

The Computer Science Club is sponsored by the Department of Computer Science and is open to all students. This organization should be of particular interest to students who desire to become acquainted with the computing profession, computing professionals and students with similar interests.

Membership in Upsilon Pi Epsilon, the international computer science honor society, is for select juniors, seniors and graduate students who maintain specified scholastic standards. Students who want to be considered for this honor should consult the Delta Chapter faculty advisor or a student officer.

DEFINITION OF MAJORS

Bachelor of Science

Computer Science Major
General Requirements:

Students must satisfy the requirements for the Bachelor of Science with a major in computer science as listed in the College of Sciences and Mathematics section of this bulletin.

Computer Science Major Requirements (43 hours)
1. CSC 102, 202, 211, 214, 241 ....15 hours
2. CSC 321 or 331, 323, 333, 341, 342...15 hours
3. CSC 411 (one hour) .... 1 hour
4. Six hours from: CSC 425, 435, 442, 447....................................6 hours
5. Six advanced hours from a list of approved computer science courses

Bachelor of Science

Computer Information Systems Major
General Requirements:

Students must satisfy requirements for the Bachelor of Science with a major in computer information systems as listed in the College of Sciences and Mathematics section of this bulletin.

Computer Information Systems Major Requirements (34 hours)
1. CSC 102, 202, 211, 214, 241 ....15 hours
2. CSC 321, 323 ....6 hours
3. CSC 411 (one hour), 426 ....4 hours
4. Nine advanced hours from a list of approved computer science courses

Bachelor of Arts

Information Technology Major
General Requirements:

Students must satisfy the requirements for the Bachelor of Arts with a major in information technology as listed in the College of Sciences and Mathematics section of this bulletin.

Information Technology Major Requirements (34 hours)
1. CSC 101 or 121, 102, 201, 211...12 hours
2. Twelve hours from: CSC 340, 350, 351, 353, 355 ....12 hours
3. Three hours from: CSC 452, 455 ....3 hours
4. CSC 411 (one hour) .... 1 hour
5. Six advanced hours of computer science ....6 hours
   (a maximum of three hours may be used from CSC 385 and 412)

DEFINITION OF MINORS

Computer Science Minor Requirements (21 hours)
1. CSC 102, 202, 211, 214, 241 ....15 hours
2. Six advanced hours from a list of approved computer science courses

At least 12 hours of computer science (six of which must be advanced) must be completed at SFA.

Must maintain a 2.0 GPA in minor courses completed at SFA, in advanced computer science courses at SFA and in computer science transfer courses.

Computer Information Systems Minor Requirements (21 hours)
1. CSC 102, 202, 211 ....9 hours
2. Twelve semester hours from the following with at least six hours being advanced: CSC 214, 241, and three-hour advanced computer science courses from an approved list ....12 hours

At least 12 hours of computer science (six of which must be advanced) must be completed at SFA.

Must maintain a 2.0 GPA in minor courses completed at SFA, in advanced computer science courses at SFA and in computer science transfer courses.

Information Technology Minor Requirements (21 hours)
1. CSC 101 or 121, 102 ....6 hours
2. Nine hours from: CSC 201 or 202, 211, 340, 350......................9 hours
3. Six hours from a list of approved interdepartmental courses..6 hours

At least 12 hours of computer science (six of which must be advanced) must be completed at SFA. Must maintain a 2.0 GPA in minor courses, in computer science courses completed at SFA, in advanced computer science courses at SFA and in computer science transfer courses.

(Contact the Department of Computer Science for the list of approved courses.)

Bachelor of Science with a Major in Computer Science

Suggested Course Sequence:

Freshman Year (33 hours)

Freshman English	3	Freshman English	3
Science	4	Science	4
MTH 139	3	MTH 233	4
CSC 102	3	CSC 202	3
Core Elective	3	Core Elective	3
	16		**17**

Sophomore Year (33 hours)

COM 111	3	ENG 273	3
Science	4	Science	4
MTH 234	4	MTH 220	3
CSC 211	3	CSC 241	3
CSC 214	3	Minor or Core Elective	3
	17		**16**

Junior Year (30 hours)

		CSC 321 or 331	3
CSC 323	3	CSC 341	3
CSC 333	3	CSC 342	3
Minor or Core Elective	9	Minor or Core Elective	6
	15		**15**

Core and Remaining Requirements:

1. Three hours from: ART 280, 281, 282; DAN 140, 341; MHL 245; MUS 140; THR 161, 370
2. Three hours from: ENG 200-233H, 300; HIS 151, 152; PHI 153, 223
3. Three hours from: AEC 261; ANT 231; ECO 231, 232; EPS 380; FOR 435; GEO 131, 230; PSY 133, 153; SOC 137, 139
4. HIS 133, 134
5. PSC 141, 142
6. CSC 411 (one hour) and six semester hours from: CSC 425, 435, 442, 447
7. Six advanced hours of computer science (restricted)
8. Elective hours as required

Minimum of 24 semester hours needed to complete the degree program in the senior year.

Bachelor of Science with a Major in Computer Information Systems

Suggested Course Sequence:

Freshman Year (32 hours)

Freshman English	3	Freshman English	3
MTH 143	3	MTH 144	3
Science	4	Science	4
CSC 102	3	CSC 202	3
Core Elective	3	Core Elective	3
	16		**16**

Sophomore Year (30 hours)

ACC 231	3	ACC 232	3
ECO 231	3	ECO 232	3
ENG 273	3	MTH 220	3
CSC 211	3	CSC 241	3
CSC 214	3	COM 111	3
	15		**15**

Junior Year (30 hours)

CSC 323	3	CSC 321	3
Core Elective	3	CSC Advanced Elective	3
ECO 339	3	BLW 335	3
GBU 325	3	FIN 333	3
MGT 370	3	Core Elective	3
	15		**15**

Core and Remaining Requirements

1. Three hours from: ART 280, 281, 282; DAN 140, 341; MHL 245; MUS 140; THR 161, 370
2. Three hours from: ENG 200-233H, 300; HIS 151, 152; PHI 153, 223
3. HIS 133, 134
4. PSC 141, 142
5. MKT 351
6. FIN 369 or GBU 147
7. CSC 411 (one hour), 426
8. Six advanced hours of computer science (restricted)
9. Elective hours as required

Minimum of 28 hours needed to complete the degree program in the senior year.

No student may enroll in any business course numbered 300 or higher unless 60 hours of coursework will have been completed by the end of the semester for which the student is enrolling.

Bachelor of Arts with a Major in Information Technology

Suggested Course Sequence:

Freshman Year (32 hours)

Freshman English	3	Freshman English	3
Science	4	Science	4
Mathematics	3	CSC 102	3
CSC 101 or 121	3	Core Elective	6
Core Elective	3		
	16		**16**

Sophomore Year (30 hours)

CSC 201	3	CSC 211	3
MTH 220	3	CSC 340 or 350	3
Minor Requirement	3	Minor Requirement	3
Core Elective	6	Core Elective	6
	15		**15**

Junior Year (30 hours)

Major Requirement	6	Major Requirement	3
Minor Requirement	3	Minor Requirement	6
Liberal/Applied/Fine Arts	3	Liberal/Applied/Fine Arts	3
Core Elective	3	Core Elective	3
	15		**15**

Core and Remaining Requirements:

1. Six to eight hours from: BCM 247; COM 111, 170; ENG 273; FRE 131, 132; GER 131, 132; GRK 131, 132; ILA 111, 112; LAT 131, 132; POR 131, 132; SPA 131, 132; SPH 172, 272
2. Three hours from: ART 280, 281, 282; DAN 140, 341; MHL 245; MUS 140; THR 161, 370
3. Three hours from: ENG 200-233H, 300; HIS 151, 152; PHI 153, 223
4. Three hours from: AEC 261; ANT 231; ECO 231, 232; EPS 380; FOR 435; GEO 131, 230; PSY 133, 153; SOC 137, 139 (ECO 231 or 232 is recommended)
5. HIS 133, 134

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6. PSC 141, 142
7. BLW 335 or GBU 325
8. Twelve hours from: CSC 340, 350, 351, 353, 355
9. CSC 411 (one hour) and three hours from: CSC 452, 455
10. Six advanced hours of computer science (restricted)
11. Minor (or second major) and elective hours as required

Minimum of 28 hours needed to complete the degree program in the senior year.

COURSES IN COMPUTER SCIENCE (CSC)
A student must have a grade of C or higher in all courses that are prerequisite to a computer science course before enrolling in that course. Unless otherwise indicated, each course carries three semester hours credit and three hours lecture per week.

101. **Introduction to Computing** - General study of computer types, capabilities, uses and limitations. Use of operating systems and application software on a microcomputer. Use of network environments to access online resources. Introduction to problem solving using a computer. Prerequisite: two years of high school algebra or equivalent. Credit not available for students who have taken CSC 121. May not be taken by business majors.

102. **Computer Science Principles** - Fundamental concepts of computer systems and systems software and an overview of computer science issues. Problem solving and program development using a high-level programming language. Prerequisite: eligibility for enrollment in college algebra.

121. **Introduction to Information Processing Systems (BCIS 1305)** - General study of computer types, capabilities, uses and limitations from a business-oriented perspective. Use of operating systems and business application software on a microcomputer. Use of network environments to access online resources. Introduction to problem solving using a computer. Prerequisite: eligibility for enrollment in a 100-level college mathematics course. Credit not available for students who have taken CSC 101.

201. **Introduction to Information Technology** - Introduction to the field of information technology, including the hardware, software and networking concepts required to understand the modern computing and communications world. Use scripting languages available on current operating systems and in the Internet environment. Prerequisiste: CSC 102.

202. **Computer Programming Principles** - Problem solving and algorithm design, program structures, data types, software development methods, and programming style. Prerequisite: CSC 102.

211. **Event-Driven Programming** - Emphasis on problem analysis, solution design and programming methods. Implementation of commercial applications. Prerequisite: CSC 102.

214. **Computer Organization and Architecture** - Architectural structure and organization of computers. Analysis of the processor components, memory structure, I/O section and bus. Study of system component interrelationships and interactions with the system kernel and selected

programming techniques. Prerequisite: CSC 202

241. Data Structures - Advanced programming techniques, including indirection and recursion. Conceptual development and implementation of data structures, including arrays, records, linear lists, stacks, queues, trees, tables and graphs. Applications involving strings, sorting, searching and file operations. Prerequisites: CSC 202; CSC 211 recommended.

301. A Contemporary Programming Language - One to three semester hours. Language constructs and applications area. Control structures, input/output, data structures. Use of language in problem solution implementation. May be repeated once for a different language. Prerequisite: six hours of computer science or the equivalent. Additional prerequisites may vary with different languages.

321. Programming Methods and File Structures - Programming efficiency techniques, debugging techniques and file processing for applications in business. Comprehensive programming assignments. Prerequisites: CSC 211; CSC 201 or 202.

323. Software Engineering - Current software engineering theory and practice. Methodologies, techniques and tools of software engineering. Prerequisite: CSC 241.

331. Object-Oriented Programming Methods - Use of a modern object-oriented programming language for industrial applications emphasizing contemporary development practices. Comprehensive programming assignments. Prerequisites: CSC 202 and 211.

333. Discrete Structures for Computer Science - Mathematical structures for describing data, algorithms and computing machines. Theory and applications of sets, relations, functions, combinatorics, matrices, graphs and algebraic structures, which are pertinent to computer science. Prerequisites: CSC 202; MTH 233 or 144.

340. Application Software for Microcomputers - Advanced utilization of spreadsheet software. Utilization of database software. Operating systems and disk management skills. May not be used to satisfy computer science requirements for a computer science or computer information systems major or a computer science minor. Prerequisite: CSC 101 or 121 or nine hours of CSC or MGT 272.

341. Principles of Operating Systems - Operating systems principles, memory management and systems utilities. Prerequisites: CSC 214 and CSC 241.

342. Algorithm Analysis - Study of algorithm design, analysis tools and techniques for selected problems, including sorting, searching, graphs, branch and bound strategies, dynamic programming, algebraic methods, string matching, and sets. An introduction to order notation, timing routines and complexity classes. Prerequisites: CSC 214 and 241.

350. Internet Technologies - Technology, structure, limitations and uses of the Internet. E-commerce and digital transactions. Webpage design. May not be used to satisfy computer science requirements for a computer science or computer information systems major or a computer science minor. Prerequisites: CSC 101 or 102 or 121.

Sciences and Mathematics

351. Internet Programming Concepts - Introduction to Internet application programming using scripting languages and user-interface design in a server-delivered, browser-based environment. May not be used to satisfy computer science requirements for a major or minor in computer science or computer information systems. Prerequisites: CSC 201 or 202 or 211; and CSC 350.

353. System Administration - The configuration, installation and maintenance of a computer using a current operating system in a networked environment. Emphasis will be placed on resource management, performance and security. May not be used to satisfy computer science requirements for a major or minor in computer science or computer information systems. Prerequisites: CSC 201 or 202 or 211.

355. Network Administration - Network administration principles, tools and techniques, including network installation, configuration, operation and maintenance. Exploration of current issues, topics and trends in network development. May not be used to satisfy computer science requirements for a major or minor in computer science or computer information systems. Prerequisite: CSC 353.

385. Internship in Computer Science - One to three semester hours. Supervised on-the-job training in one or more facets of the field of computer science. Prerequisites: Advanced standing as a major or minor in the Department of Computer Science, three advanced hours of computer science, overall GPA of 2.5 or higher, computer science GPA of 2.5 or higher and consent of the CSC 385 course supervisor. May not be used to satisfy computer science requirements for a computer science or computer information systems major, or any minor in the Department of Computer Science. May be repeated to a total of three hours credit. Pass or fail.

401. Contemporary Topics in Computer Science - One to three semester hours. Study of recent developments and topics of current interest in computer science. A student may repeat this course once with department chair approval. May be used only once to partially satisfy the 400-level course requirement in computer science. Prerequisites: six advanced hours of computer science or department chair approval. Particular prerequisites may vary with different topics.

411. Ethics in Computer Science - One semester hour. Study of ethical concepts to guide computing professionals. Implications and effects of computers on society. Responsibilities of computing professionals in directing emerging technology. May not be used to satisfy requirements toward a minor in computer science, computer information systems or information technology. Prerequisites: 18 hours of computer science with at least six hours advanced and department chair approval.

412. Computer Science Practicum - Operation and supervision of computer facilities in a production and student environment. May not be used to satisfy advanced computer science requirements for a computer science or computer information systems major, or any minor in the Department of Computer Science. Prerequisites: 18 hours of computer science with at least six hours advanced and department chair approval.

421. Applied Operations Research - Quantitative techniques for resource management, decision-making and system analysis with emphasis on

development and use of computer implementations of mathematical models. Prerequisites: CSC 241; MTH 144 or 233; MTH 220.

425. Database Management Systems - Study of database management systems. Design and implementation of applications using database management systems. Prerequisites: CSC 241; CSC 321 or 331; three additional advanced hours of computer science excluding CSC 340, 350, 351, 353, 355, 385, 411, 412, 433, 452 and 455.

426. Requirements Engineering and System Modeling - Study of the methodology for building a complete application system. Emphasis on critical analysis of existing systems and design of computer-based systems. Prerequisite: CSC 323.

431. System Simulation and Model Building - Simulation methodology, generation of random variants, design of experiments with deterministic and stochastic models. Prerequisites: CSC 241; MTH 144 or 233; MTH 220.

433. Information Technology Project Management - This course addresses the need for I.T. developers and analysts to develop and manage large I.T.-related projects. This course will cover developmental life cycles and discuss requirements of collection and analysis. It also will include coverage of multiple areas of I.T. project management such as quality management, human resource management, project scope management, etc. Project management approaches and stakeholder management also will be addressed. May not be used to satisfy computer science requirements for a computer science or computer information systems major or minor. Prerequisite: Nine advanced hours of computer science.

435. Computer Networking - Functional evolution and role of data communications. Considerations in data communications. Applications in general. The design issues. System components and their interrelationships. Networks. Prerequisites: CSC 241; CSC 323 or 333 or 341 or 342.

442. Organization of Programming Languages - Language definition, structure, data types, control structures, parameter passage, subprogram interface and block-structured language. Information binding, data storage and mapping, execution environments, input/output, recursion, multiprocessing. Prerequisites: CSC 241; CSC 321 or 331.

445. Computer Graphics - Overview of the hardware, software and techniques used in computer graphics. Graphics primitives, two-dimensional transformations, painting, windowing and clipping. Three-dimensional graphics, including hidden lines and surfaces, lighting, texturing, and shading. Prerequisites: CSC 323 or 341 or 342; MTH 133.

447. Cyber Security Concepts and Practices - Study of computer and internet security, concepts and practices. Introduction to cryptography and information security. Understanding the different types of malware and how to prevent them. Cloud computing and emerging technologies, security risks and practices. Prerequisites: CSC 241 and 331.

452. Database Application Development - Applied study of the logical and physical organization of database systems and their role in information technology. Design and implementation of applications using database

management systems. May not be used to satisfy computer science requirements for a major or minor in computer science or computer information systems. Prerequisites: CSC 340 and 351.

455. **Enterprise Security** - Practical approaches to ensuring the security of information systems. May not be used to satisfy computer science requirements for a major or minor in computer science or computer information systems. Prerequisites: CSC 321 or 331 or 355.

475. **Special Problems** - One to three semester hours. Individual instruction in computer science. May be repeated once for a different topic with department chair approval. Prerequisites: junior standing and department chair approval.

DEPARTMENT OF GEOLOGY

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AREAS OF STUDY
AND DEGREE

B.S. Geology

FACULTY

Professors
  Wesley A. Brown, R. LaRell Nielson
Associate Professors
  Chris A. Barker, Kevin W. Stafford
Assistant Professors
  Melinda Shaw Faulkner, Liane M. Stevens
Instructor
  Patricia S. Sharp
Lecturer, Lab Coordinator
  Wesley L. Turner

OBJECTIVES
Studies and training in geology are designed:
• to give students an understanding of the methods of science and the fundamentals of Earth science as they relate to the physical environment and our dependence on Earth resources, such as minerals, rocks, fuels, ores and water
• to give prospective science students the fundamentals of geology as a foundation for other science studies
• to provide training in geology and related Earth sciences as an area of specialization for prospective elementary and secondary school teachers
• to provide geology majors with a broad foundation in geology for future professional work or graduate study.

STUDENT ORGANIZATIONS
• American Association of Petroleum Geologists
• Association of Environmental and Engineering Geologists
• Geology Student Association
• Sigma Gamma Epsilon

DEFINITION OF MAJORS AND MINORS
Students wishing to choose geology as a major should consult the advisor of the department early in their university career. The geology program includes a required core curriculum for all majors plus additional courses from a choice of two options: the general geology option and the environmental geology option. Therefore, no single curriculum can be listed for all majors.

Geology Major Requirements: Bachelor of Science

Core Geology Courses (34 hours)
• GOL 131, 132, 241, 242, 338, 364, 408 and 472L (Field Methods)

General Geology Option Requires:
The geology core plus 435 and 443, plus three geology courses from these choices:
• GOL 330, 332, 361, 410, 420, 422, 430, 440, 449

Plus co-requisites:
- CHE 133, 134 and PHY 131, 132
- MTH 220, 233

Environmental Geology Option Requires:
The geology core plus 420 and 449, plus three geology courses from these choices:
- GOL 303, 330, 350, 422, 430, 435, 440, 450, 451

Plus co-requisites:
- CHE 133, 134 and either PHY 131, 132 or BIO 131, 133
- MTH 220, 233

A minimum grade of C is required in all geology courses numbered 200 or higher to receive the B.S. in geology. Students must complete Chemistry 133 and 134; Physics 131 and 132 or Biology 131 and 133; and Math 220 and 233 with all co-requisite courses before they can register for GOL 338, 364, 408, 420 and 443.

Students at SFA plan their minor program in consultation with a geology advisor. Suggested minors are chemistry, biology, physics, mathematics, business, computer science, geographic information systems (GIS) and geography.

Geology Minor (18 hours)
A minor in geology consists of a minimum of 18 semester hours of which at least six hours must be advanced. No more than two hours of GOL 471 allowed.

SECOND MAJOR PROGRAMS

The courses in geology required by the major in environmental sciences with environmental geology option (College of Forestry and Agriculture) or the major in geography with geology minor make it possible for the interested student to complete a second major in geology during the normal four-year period for the bachelor's degree. Contact the Department of Geology for advising.

Curriculum for Geology Majors Bachelor of Science

(Suggested Sequence)

Freshman Year (28-29 hours)

Fall		Spring	
GOL 131 plus GOL 131L	4	GOL 132 plus GOL 132L	4
ENG 131	3	ENG 132	3
CHE 133 & 133L	4	CHE 134 & 134L	4
MTH 133, 138, 140 or 233	3-4	MTH 220	3
	14-15		**14**

Sophomore Year (33 hours)

Fall		Spring	
GOL 241	4	GOL 242	3
ENG 273	3	HIS 134	3
PHY 131 & 131L or		PHY 132 & 132L or	
BIO 131 & *131L	4	BIO 133 & *133L	4
HIS 133	3	Language, Philosophy, Culture	3
GOL (option choice)	3	Communications	3
	17		**16**

Junior Year (31 hours)

Fall		Spring	
GOL (Option choice)	3	GOL 338	3
GOL 408	3	GOL (option choice)	3
Social and Behavioral Sciences	3	Creative Arts	3
PSC 141	3	PSC 142	3
GOL (option choice)	3	CSC 101 or 121	3
	15	GOL 472L	1
			16

Summer Field Geology (6 hours)

GOL 364 (Summer I)	6

Senior Year (21 hours)

Fall		Spring	
Major, Minor	12	Major, Minor	9
	12		**9**

*Environmental Option only

COURSE CREDIT

Unless otherwise indicated, courses are three semester hours credit, three hours lecture per week.

Courses that are co-requisites must be taken together during the same semester.

Separate grades will be awarded for GOL 131, 131L, 132 and 132L. For these specific courses, withdrawal from one course requires dropping the co-requisite course. A student is not required to repeat a co-requisite for which the student has received a minimum grade of C.

COURSES IN GEOLOGY (GOL)

101. Fundamentals of Earth Science - Two hours lecture, two hours laboratory per week. An introduction to the fundamental principles of Earth science. Topics include the Earth's structure and surface landforms; mineral and energy resources; geologic hazards such as volcanoes, earthquakes and landslides; water resources and the unifying theory of plate tectonics. May not be taken by geology majors. Lab fee required. Co-requisite: GOL 101L.

131. Introductory Geology - Three semester hours. Designed for the student with no geology background. Introduction to the study of minerals, rocks and the processes that modify and shape the surface features of the Earth. Focus on energy, mineral and water resources; volcanism; and other practical aspects of geology. Co-requisite: GOL 131L. No prerequisites.

131L. Introductory Geology Lab - One semester hour, two hours laboratory per week. Co-requisite: GOL 131. Required lab fee.

132. The Earth Through Time - Three semester hours. The history and development of the continents and ocean basins and the evolution of life on Earth; includes earthquakes and the Earth's interior, mountain building, drifting continents and sea-floor spreading, the Ice Ages, space science and oceanography. Co-requisite: GOL 132L. Prerequisite: GOL 131.

132L. **The Earth Through Time Lab** - One semester hour, two hours laboratory per week. Co-requisite: GOL 132. Required lab fee.

241. **Mineralogy** - Four semester hours, three hours lecture, three hours laboratory per week. Properties of crystals and crystal systems, identification and classification of selected minerals in hand specimen, rock associations, and mode of occurrence of minerals and industrial uses. Prerequisites: GOL 131 and CHE 133. Co-requisite: GOL 241L. Required lab fee.

242. **Petrology** - Two lecture hours, three laboratory hours per week. Identification, origin, occurrence and association of igneous, metamorphic and sedimentary rocks. Prerequisites: GOL 131, 132 and 241. Required field trip, field trip and lab fees. Co-requisite: GOL 242L.

303. **Oceanography** - Three hours lecture per week. Study of the marine environment with emphasis on the structure, properties, and processes of the ocean and their role in the total environment. Prerequisite: GOL 131.

330. **Geomorphology** - Three hours lecture per week. Genesis, characteristics and analysis of land forms based on a consideration of geological processes, stages of development and geological structures. Prerequisite: GOL 131 or GEO 130.

332. **North American Geology** - Three hours lecture per week. Study of the geologic evolution, history and framework of the North American continent. Prerequisite: GOL 132.

338. **Structural Geology** - Two hours lecture, three hours laboratory per week. Genesis, classification and description of structural features resulting from rock deformation. Required field trips. Required lab and field trip fees. Prerequisites: CHE 134; MTH 220, 233; GOL 242, 408; as well as either BIO 131, 133 or PHY 132. Co-requisite: GOL 338L.

350. **Environmental Geology** - Three hours lecture. Study of geological phenomena that are important in man's effective utilization of his physical environment, including soils, land use and geologic hazards. Prerequisite: GOL 131.

361. **Invertebrate Palaeontology** - Three semester hours, two hour lecture, three hours laboratory per week. Morphology, classification, evolutionary history, ecology and geologic significance of the major groups of invertebrate fossils. Prerequisite: GOL 132 or permission of the instructor. Required lab fee. Co-requisite: GOL 361L.

364. **Field Geology** - Six semester hours, summer camp, SSI. Capstone course of the Department of Geology. Required of all geology majors in order to graduate with the B.S. degree in geology. Methods and application of geologic field techniques. Emphasis on reconnaissance and detailed mapping. Prerequisites: GOL 338, 408; CHE 134; MTH 220, 233; as well as (either BIO 131, 133 or PHY 132). Required field trip fee.

406. **Earth Science Activities** - Four semester hours. Three lecture hours, two hours laboratory per week. Practical applications of Earth science principles from geology, oceanography, astronomy and meteorology; designed for students preparing to become elementary or secondary teachers. Co-requisite: GOL 406L. Required lab fee.

408. **Stratigraphy and Sedimentation** - Two hours lecture, three hours laboratory per week. Study of basic stratigraphic relations and the identification, origin, distribution and correlation of sedimentary rocks. Required lab fee. Prerequisites: GOL 242; MTH 220, 233; CHE 134 plus either BIO 131, 133 or PHY 132. Co-requisite: GOL 408L.

410. **Engineering Geology** - Two hours lecture and three hours laboratory per week. Application of geology to engineering practice. Topics include soil mechanics, foundations, engineering classification of soils, slope stability and drainage and storm water management. Prerequisites: GOL 131; MTH 133. Co-requisite: GOL 410L. Required lab fee.

420. **Geochemistry** - Two hours lecture and three hours laboratory per week. Applications of chemical laws and methods to the solution of geological problems. Prerequisites: GOL 131; CHE 134; MTH 138, 220. Co-requisite: GOL 420L. Required lab fee.

422. **Geoenvironmental Characterization** - Three semester hours, three hours lecture per week. This course provides an introduction for students interested in learning field techniques used to characterize the geologic environment and basic mathematical and computational skills necessary to interpret data collected in the field and processed in the laboratory, including spreadsheet operations, data retrieval and statistical analyses. Prerequisites: GOL 131 and CHE 133, or permission of the instructor.

430. **Fundamentals of Plate Tectonics** - Three semester hours, three hours lecture per week. Plate tectonic theory provides a fundamental framework for understanding Earth's geological and geophysical phenomena. This course will explore the development, strengths and limitations of plate tectonic theory. Topics include Earth's structure and isostasy, paleomagnetic data, detailed examination of plate boundaries and orogenesis, modern and reconstructed plate configurations, plate kinematics and controlling forces, and the supercontinent cycle. Prerequisites: GOL 131 and 132.

435. **Introduction to Geophysics** - Two hours lecture and three hours laboratory per week. Introduction to the basic theories and methodologies of the major geophysical methods. This course reviews the benefits and limitations of the main geophysical techniques. Prerequisites: GOL 131, 132; MTH 133 or 140; PHY 132 or permission of instructor. Co-requisite: GOL 435L. Required lab fee.

440. **Earth Resources** - Three semester hours, three hours lecture per week. This course provides an introduction to the geologic and economic factors that result in the development of commercial concentrations of mineral resources. Emphasis will be placed on the descriptive geology and origin of economic mineral concentrations within the context of their overall geologic settings. The geologic and economic nature of metallic and industrial mineral commodities in varied geologic environments will be discussed. Related topics to be discussed include importance of mineral resources to the global economy, mineral exploration and evaluation, and mineral extraction and processing. Prerequisites: GOL 131, or permission of the instructor.

Sciences and Mathematics

443. **Optical Mineralogy** - Two hours lecture and three hours laboratory per week. Optical behavior of crystals and identification of rock-forming minerals with the polarizing microscope. Prerequisites: GOL 241; MTH 220, 233; CHE 134; as well as either BIO 131, 133 or PHY 132. Required lab fee. Co-requisite: GOL 443L.

449. **Ground Water** - Two hours lecture and three hours laboratory per week. Principles of occurrence and movement of water beneath the Earth's surface and the influence of various geologic situations upon its behavior, depletion, recharge and contamination of ground water supplies. Prerequisites: GOL 131, MTH 138, CHE 133. Required lab fee. Co-requisite: GOL 449L.

450. **Cave and Karst Systems** - Three hours lecture. This course will explore the underground world of caves as students are introduced to the complexities of karst systems, including the geologic and hydrologic controls on porosity evolution in soluble rocks. Students will learn characteristics and behavior of fluid flow through multi-permeability systems as it applies to karst aquifers and mineral deposits. Students will be introduced to the unique environmental and engineering concerns associated with karst terrains and groundwater resources. Prerequisites: GOL 131, 132 or permission from faculty.

451. **Hydrogeology Field Techniques** - Two hours lecture and three hours laboratory per week. This course emphasizes the various techniques utilized in groundwater studies for characterization and monitoring of water resources. Students will learn how to evaluate aquifers, including practical field experience that emphasizes the various requirements and procedures involved in hydrogeologic sampling. Students will conduct field exercises that investigate groundwater, including well design, well installation and aquifer characterization. Prerequisites: GOL 449. Required lab fee. Co-requisite: GOL 451L.

471. **Special Topics in Geology** - One to four semester hours. Study of specific areas in geology.

472L. **Field Methods** - One credit hour, three hours laboratory per week. Designed to give the student practice using field equipment and to learn and apply geologic principles in the field. Prerequisites: GOL 242, 408; MTH 220, 233; CHE 134; plus either BIO 131, 133 or PHY 132. Required lab fee.

475. **Special Problems** - One to four semester hours. Individual study in some field of geology, guided through individual conference with professor in charge. May be repeated once. Prerequisites: 18 hours of geology and approval of department chair. Permission of instructor must be obtained prior to enrollment.

DEPARTMENT OF MATHEMATICS AND STATISTICS

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AREAS OF STUDY AND DEGREE

B.S. Mathematics

Minors:
Mathematics
Applied Statistics

FACULTY

Professors
Jeremy Becnel, Lesa L. Beverly, Kimberly M. Childs, William D. Clark, Roy Joe Harris, Keith E. Hubbard, Gregory K. Miller, Deborah A. Pace, Sarah T. Stovall

Associate Professors
Matthew Beauregard, Brian Beavers, Robert K. Henderson, Thomas W. Judson, Jane H. Long, Nicholas Long, Clint Richardson, Kent Riggs

Assistant Professors
Brittney Falahola, Lynn Greeleaf, Ryan Jensen, Jonathan L. Mitchell, Jacob Turner

Lecturers
Michelle Cook, Lorna W. DeSha, Angela Dixon, Hilary P. Dosser, Danielle Johnson, Julie L. Lewis, Robert Payne, Stacia Prince, John R. Sullivan, Robin Sullivan

OBJECTIVES

Specific roles of the department are to provide an engaging and relevant curriculum that prepares students who are:

- planning a career in business and industry that requires a strong foundation in mathematics or statistics,

- pursuing a major in a partner discipline, but who need mathematics or statistics as a tool or to satisfy general degree requirements,

- planning to pursue a graduate degree in mathematical sciences, or

- planning to teach in colleges, universities and public or private schools.

STUDENT ORGANIZATIONS

A student chapter of the Mathematical Association of America is sponsored by the Department of Mathematics and Statistics. Membership is open to any student interested in the mathematical sciences. Benefits include reduced membership fees for the MAA and informative meetings about topics in mathematical sciences and career opportunities in mathematical sciences. Interested students should consult the MAA Student Chapter sponsor.

Pi Mu Epsilon is a Mathematical Honor Society whose purpose is the promotion of scholarly activity in mathematics among students in academic

institutions and among staffs of qualified non-academic institutions. A chapter of Pi Mu Epsilon may be chartered only in an academic institution whose standards are excellent in all liberal arts departments and particularly in mathematics. The Texas Delta Chapter of Pi Mu Epsilon is located at SFA. Interested students should consult the faculty sponsor about membership requirements and nomination for membership.

STUDENT SCHOLARSHIPS AND FINANCIAL AID
Several undergraduate scholarships are available to promising mathematics students in memory of Dr. C.E. Ferguson, and Jasper E. Adams, both former chairs, and Jason Balusek, former graduate student of the Department of Mathematics at SFA. An additional award is available in honor of Joseph G. McWilliams, a former professor in the department. The Alexander, Clark, Hurd, Neel, Pruitt, and Pinson scholarships also are available to qualified students; applications are available through the SFA Alumni Association.

The department offers additional scholarships based entirely on academic excellence. Eligible students are those with a major or minor in mathematics or statistics and those seeking teacher certification with a specialization in mathematics; applications are available through the department.

Part-time employment is available for mathematics majors and minors who have completed designated courses with good academic records.

DEFINITION OF MATHEMATICS MAJOR (40 HOURS)
A major in mathematics consists of MTH 233, 234, 311, 317, 333, 337, 359, 360, 412, 439, 440, 463, plus three hours from MTH 305, 351 and 415. CSC 102 or equivalent is required.

After completing 45 hours of college credits, including MTH 233 and 234 with a minimum grade of C, a student should consult with the dean of the College of Sciences and Mathematics concerning a degree plan.

DEFINITION OF MATHEMATICS MINOR (18 HOURS)
A minor in mathematics consists of MTH 233, 234 plus courses selected from MTH 305, 311, 317, 333, 337, 351, 359, 360, 412, 415, 439 and 440 for a minimum of 18 semester hours.

DEFINITION OF APPLIED STATISTICS MINOR (18 HOURS)
A minor in applied statistics consists of MTH 144 or 233; MTH 220; and STA 320, 321, 322 and 327.

CERTIFICATION FOR MATHEMATICS TEACHING FOR GRADES 7-12 (40 HOURS)
The major in mathematics with teacher certification for grades 7-12 requires MTH 233, 234, 311, 317, 333, 337, 351, 359, 360, 412, 439, 440 and 463. CSC 102 or equivalent is required.

*Note: Refer to the Educator Certification portion of this bulletin in the James I. Perkins College of Education section for specific professional teacher education coursework requirements.

Students who anticipate doing graduate study in mathematics or statistics should so indicate to their advisors, who will help them plan their program accordingly.

Students who are interested in an area of specialization in mathematics for teaching in grades 4-8 should refer to the Educator Certification section of this bulletin.

THE MATHEMATICS AND STATISTICS GRADUATE PROGRAM
Those interested in the graduate program in mathematics and/or statistics should consult the Graduate Bulletin.

Major in Mathematics: Bachelor of Science (120 hours)

Curriculum for Majors

Freshman Year (34 hours)

Mathematics	3-4	Mathematics	3-4
Natural Science-Astronomy, Biology, Chemistry, Geology or Physics	4	Natural Science-Astronomy, Biology, Chemistry, Geology or Physics	4
Freshman English	3	Freshman English	3
Minor/Core Req.	6	Minor/Core Req.	6
	16-17		**16-17**

Sophomore Year (30 hours)

Mathematics	3-4	Mathematics	3-4
Literature or Mythology	3	HIS 134 or PSC 142	3
HIS 133 or PSC 141	3	Lab Science	4
Lab Science	4	Electives	3
CSC 102	3		
	16-17		**13-14**

Junior Year (28 hours)

Major, Minor and Electives	**28**

Senior Year (28 hours)

Major, Minor and Electives	**28**

GENERAL EDUCATION REQUIREMENTS
The student's courses must be chosen so that the general education requirements, as listed in Degree Requirements, Bachelor of Science (mathematics) earlier in this section, are satisfied.

GENERAL COURSE PREREQUISITES
All credit-level mathematics courses have prerequisites of two years of high school algebra and one year of high school geometry and TSI complete/exempt status in mathematics. In addition, for placement into MTH 140, students must have a minimum math score of 25 on the ACT or 600 on SAT. This course is recommended only for students interested in proceeding to MTH 233.

The Department of Mathematics and Statistics strongly recommends a minimum math score of 21 on ACT, 530 on SAT or a C or higher in MTH 099 before taking any credit-level mathematics course.

A minimum grade of C is required in all courses that are prerequisite to a mathematics or statistics course.

COURSES IN MATHEMATICS AND STATISTICS (MTH)

Unless otherwise indicated, courses are three semester hours credit with three hours lecture per week.

098. **Introductory Algebra** - A non-credit course designed to prepare students to be successful in MTH 099. Basic operations and properties of real numbers, geometry, beginning algebraic concepts, simplification, linear equations, applications, linear graphs, polynomials. Includes instruction in proper mathematical organization and math-specific study skills. May be required of students with a marginal background in mathematics.

099. **Intermediate Algebra** - One to three semester hours. A non-credit course designed to prepare students to be successful in entry-level credit math classes. Properties of real numbers, techniques of algebraic simplification, first and second order equations, linear inequalities, sets, functions, graphs, polynomials, rational expressions, radicals, applications. Instruction in proper mathematical organization, communication and math-specific study skills. May be required of students with a marginal background in mathematics.

110. **Math in Society (MATH 1332)** - Provides an introduction to mathematical thinking emphasizing analysis of information for decision-making. Prerequisites: see General Course Prerequisites.

127. **Introduction to Foundations of Mathematics I (MATH 1350)** - Properties of the natural numbers, integers, rational and real number systems, and number theory, with an emphasis on problem solving and critical thinking. Prerequisites: see General Course Prerequisites.

128. **Intermediate Mathematics for Elementary Teachers (MATH 1351)** - Elementary concepts of geometry and measurement, probability, and statistics with an emphasis on problem solving and critical thinking. Prerequisite: MTH 127.

129. **Concepts and Applications** - Problem-solving and critical-thinking skills applied to the study of a broad range of topics, including number theory, sequences and series, recursion, data analysis, mathematical modeling and algebra, including connections to the grades EC-6 classroom. Prerequisites: MTH 127 and 128.

133. **Plane Trigonometry (MATH 1316)** - Trigonometric functions of angles, radian measure, fundamental identities; addition, product, and half angle formulas, solution of triangles; polar coordinates; inverse trigonometric functions, complex numbers. Prerequisites: see General Course Prerequisites.

138. **College Algebra (MATH 1314)** - Mathematical models; solving equations; creating, interpreting and graphing functions. Particular focus is given to polynomial, exponential and logarithmic functions. Prerequisites: see General Course Prerequisites.

139. **Plane Analytic Geometry (MATH 1348)** - A beginning course in plane analytic geometry, including the straight line, the circle, parabola, hyperbola and the transformation of coordinates. Prerequisites: MTH 133 and 138 or the equivalent.

140. Pre-calculus (MATH 2412) - Four semester hours. Preparatory for the calculus sequence: properties and graphs of algebraic, exponential, logarithmic, and trigonometric (with inverses); fundamental trigonometric identities, conic sections, polar and rectangular coordinate systems. Prerequisites: see General Course Prerequisites.

143. Finite Mathematics (MATH 1324) - Mathematical functions and graphs, linear systems of equations, matrices, linear programming, mathematics of finance; applications. Prerequisites: see General Course Prerequisites.

144. Elements of Calculus with Applications for Business (MATH 1325) - Limits and continuity, the derivative, the anti-derivative, the definite integral; applications. Prerequisite: MTH 143..

220. Introduction to Probability and Statistics (MATH 1342) - Probability, random variables, mean and variance, binomial distribution, normal distribution, statistical inference and linear regression. Prerequisites: see General Course Prerequisites.

233. Calculus I (MATH 2413) - Four semester hours. Limits, continuity, differential calculus of algebraic and transcendental functions with applications, basic antidifferentiation with substitution, definite integrals. Prerequisite: MTH 139 or MTH 140.

234. Calculus II (MATH 2414) - Four semester hours. Applications and techniques of integration, improper integrals, infinite series and power series. Prerequisite: MTH 233.

264. Elementary Topics in Mathematics and Statistics - Elementary topics in scientific computing, algebra, number theory, applied mathematics, geometry, probability and statistics. May be repeated once for credit on a different topic. Does not count toward a major or minor in mathematics. Prerequisite: see General Course Prerequisites.

275. Special Problems - One to three semester hours. Individual in-depth study or research in special topics in mathematics, statistics or mathematics education beyond the core mathematics curriculum. May be taken for honors credit.

300. Foundations of Mathematics - Set theory, relations, functions, mathematical structure, logic and proof. Includes historical connections. MTH 138 and 129.

301. Concepts of Calculus - Limiting processes and other concepts of calculus. Includes analysis of numerical approaches to problem solving using technology and appropriate software with historical and grades 4-8 connections. Students will be required to have a graphing calculator. Prerequisite: MTH 300.

302. Concepts in Geometry - Survey of geometric topics with an emphasis on trigonometry and Euclidian geometry. Includes historical and grades 4-8 connections. Prerequisite: MTH 300.

305. Introduction to Numerical Methods - Basic numerical and computational techniques used in the solution of mathematical problems in the real world: approximation of functions, roots and systems of equations, numerical integration, interpolation and curve-fitting, and machine computation. Prerequisites: MTH 234 and CSC 102 or equivalent.

Sciences and Mathematics

311. **Introduction to Modern Mathematics** - Introduction to logic, basic properties of sets, relations, functions, one-to-one functions, set equivalence, Cantor's Theorem, countable and uncountable sets. Prerequisite: MTH 234.

317. **Linear Algebra** - Matrices, systems of linear equations, linear vector spaces, functions from Rn to Rm, determinants, eigenvalues and eigenvectors. Prerequisites: MTH 311, or 234 and consent of instructor.

320. **(STA 320) Statistical Methods** - Analysis of variance, regression analysis and nonparametric methods. The course will stress the use of computer packages MINITAB or SAS and the interpretation of the outputs. Prerequisite: MTH 220.

321. **(STA 321) Applied Nonparametric Statistics** - Contingency table analysis, rank tests for one, two and many sample problems, rank correlation, introduction to nonparametric regression. Prerequisite: MTH 220.

322. **(STA 322) Regression** - Regression and model building, measure of model adequacy, transformations, prediction. Prerequisites: MTH 144 or 233, and STA 320.

327. **(STA 327) Experimental Design and Analysis** - Analysis of variance, completely randomized designs, blocking and Latin square designs. Multifactor experiments, including factorial experiments, nested, blocked and split-plot designs. Analysis of covariance. Quality control, sampling theory, reliability issues. SAS or other statistical software used throughout. Report writing, data driven problems and/or case studies incorporated throughout. Prerequisite: STA 320.

333. **Calculus III** - Four semester hours. Vectors, vector operations and vector functions; multivariate functions, partial derivatives, gradients and multiple integrals; integration in vector fields, Green's, Stokes' and the Divergence theorems. Prerequisite: MTH 234.

337. **Differential Equations** - Solving of differential equations of physics, chemistry and engineering, and a study of the characteristics of the solutions. Prerequisite: MTH 333 (or concurrent enrollment).

351. **College Geometry** - Survey of topics from classical Euclidean geometry, modern Euclidean geometry, projective geometry, transformational geometry and non-Euclidean geometries. Prerequisite: MTH 311.

359. **Probability Modeling** - Elementary probability laws, conditional probability, the language of random variables and stochastic processes, modeling with discrete and continuous probability distributions, applications among various stochastic processes, methods of estimating parameters. Prerequisite: MTH 234.

360. **Statistical Inference** - Covariance and correlation, sampling distributions, development and data analysis concerning one/two/many sample location tests and confidence intervals. Analysis of variance and simple linear regression, chi-squared tests for categorical data. Use of technology and/or statistical software throughout. Prerequisites: MTH 333 (or concurrent enrollment) and 359.

412. **Introduction to Algebraic Systems** - Introduction to the study of algebraic systems with particular emphasis on concrete examples of the

basic algebraic structures, groups, rings, integral domains and fields. Prerequisites: MTH 311 and 317.

415. **Number Theory** - Properties of natural numbers. Unique factorization, residue solution of congruences, arithmetic functions, quadratic reciprocity law, distribution of primes. Diophantine equations, continued fractions, algebraic numbers. Prerequisite: MTH 311.

439. **Introduction to Analysis I** - Elements of point set theory and an in-depth study of the basic ideas of sequences, limits, continuity and differentiability. Prerequisites: MTH 311 and 333.

440. **Introduction to Analysis II** - Continuation of MTH 439 with topics in Taylor, Fourier and other special series, and an in-depth study of Riemann-Darboux Integration. Prerequisite: MTH 439.

463. **Seminar in Mathematics** - One, two or three conference hours per week. Student participation in general and specific topics in mathematics; separate section for mathematics teacher certification. May be repeated for credit on a different seminar topic with departmental approval. Prerequisite: MTH 439 (or concurrent enrollment).

464. **Advanced Topics in Undergraduate Mathematics and Statistics** - One, two or three semester hours. Topics in abstract algebra, analysis, applied mathematics, geometry, probability and statistics, topology, or the teaching of mathematics. May be repeated once for credit on a different topic. Prerequisite: consent of the instructor.

475. **Special Problems** - One, two or three semester hours. Study and research for individual instruction of the undergraduate student. Prerequisites: 15 semester hours of mathematics and an overall minimum B average in completed college work.

476. **Special Problems** - One, two or three semester hours. Same as 475 for credit in a different topic. Study and research for individual instruction of the undergraduate student. Prerequisites: 15 semester hours of mathematics and an overall minimum B average in completed college work.

RICHARD AND LUCILLE DEWITT SCHOOL OF NURSING

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Erin Bailey, Operations Coordinator
Chris Bray, MSN Coordinator
Tammy Harris, BSN Coordinator
Janice Hensarling, MSN Assistant
Coordinator
Karen Migl, RN-BSN Coordinator

AREAS OF STUDY AND DEGREE

B.S. Nursing

FACULTY

Associate Professors
Sara Bishop, Janice Hensarling, Cindi McCarley, Karen Migl, Rose Powell

Assistant Professors
Erin Bailey, Susan Ballard, Della Connor, Tammy Harris, Angela Jones, Christopher Ryan, Sherry VanMeter

Visiting Professor
Chris Bray

Clinical Instructors
Carol Athey, Sheree Barrios, Kesha Becnal, Angel Brewer, Kim Deaton, Shelley Hunt, Michelle Klein, Laura Logan, Regina Low, Debra McCarthy, Dorothy (Joanie) Selman, Celina Serna, Joy Shupak, Veronica Sjolander, Crystal Talavera, Katy Trotty, Jessica Williams, Allison Younger

Ed and Gwen Cole Simulation Laboratory Coordinator
Rebecca Self

MISSION/PHILOSOPHY

Our mission is to provide students a foundation for success as graduate nurses who are ethical, competent critical thinkers by providing an educational environment that promotes holistic health care in an educational community dedicated to teaching, research, creativity and service.

CORE VALUES FOR THE SCHOOL OF NURSING

- Teaching and Learning: Facilitation of meaningful learning that provides a university-level foundation on which to base graduate education in the discipline of nursing. Each nursing graduate is expected to meet the academic and ethical standards of the profession of nursing by thinking in disciplined, critical, quantitative, qualitative ways.

- Intellectual and Creative Discovery: Encourage the student to investigate the health needs of a changing society and to think in creative ways to provide holistic health care to culturally diverse populations.

- Service: Interdisciplinary collaboration to meet the needs of culturally diverse populations.

- Academic Achievement: Provide an environment in which the student becomes an ethically guided critical thinker who uses a substantive general education in traditional and nontraditional ways to provide proactive,

compassionate care.

- Nursing: A profession of arts and science dedicated to facilitating, nurturing and providing unconditional acceptance in the attainment of an individual's maximum potential. Nursing encourages positive integration of cognitive, affective and psychomotor learning to build cognitive structures for problem solving.

- Health: Maximum potential denoted by dynamic equilibrium among various cognitive, psychosocial, emotional and physiological subsystems of the client.

- Environment: Internal/external stressors/distressors experienced by the client.

- Client/Student: An individual, group or community with unique genetic endowment, self-care knowledge and resources, perception and culture, experiences and adaptation potential. The client/student is a valued and respected partner in achieving maximum potential.

- Evidenced-based Practice: Integration of current research with clinical expertise and client/student preferences and values for achievement of maximum potential.

TERMINAL OBJECTIVES FOR GRADUATES OF THE SCHOOL OF NURSING (STUDENT OUTCOMES)

The student will:
1. Apply knowledge of the physical, social and behavioral sciences in the provision of nursing care based on theory, research and evidence-based practice.
2. Deliver nursing care within established legal and ethical parameters in collaboration with clients and members of the interdisciplinary health care team.
3. Provide holistic nursing care to individuals, families, communities and society as a whole while respecting individual and cultural diversity.
4. Demonstrate effective leadership that fosters independent thinking, use of informatics and collaborative communication in the management of nursing care.
5. Assume responsibility and accountability for quality improvement and delivery of safe and effective nursing care.
6. Serve as an advocate for clients and for the profession of nursing.
7. Demonstrate continuing competence, growth and development in the profession.

STUDENT SCHOLARSHIPS

Many scholarships are available to students entering the nursing program at SFA. These scholarships have been established through the generosity of individuals, family members and organizations that recognize and support the role of education in the advancement of the nursing profession. Further information regarding nursing scholarships may be obtained by contacting the Alumni Association or the Office of Development. The development office administers the Albert and Wilda Harris Scholarship and the Betty Baker Cardiovascular Scholarship, in collaboration with the School of Nursing. The scholarship list may be found on the nursing website at nursing.sfasu.edu.

Army ROTC also provides two-, three- and four-year scholarships to nursing students with an opportunity to attend specialized training while still in school. Contact the Department of Military Science for further details.

The Richard and Lucille DeWitt Scholarship for SFA nursing students is coordinated through Nacogdoches Memorial Hospital. Information about this

scholarship can be found on the nursing website at nursing.sfasu.edu.

STUDENT ORGANIZATIONS
Student Nurses Association

HONOR SOCIETY
Sigma Theta Tau International Nurse's Honor Society, Omicron Eta Chapter

ADMISSION REQUIREMENTS
A student requesting admission to the baccalaureate program in nursing must meet the following criteria:

Full Admission
1. Acceptance to SFA.

2. Overall GPA of 2.5 in college work, including transfer courses.

3. Science GPA of 2.75 in college work, including transfer courses. Courses calculated for science GPA are: BIO 238, 239; CHE 111; NUR 304; BIO 308. Students are encouraged to take the science classes at SFA.

4. Successful completion of the entrance testing. Scores to be submitted to School of Nursing. Tests may be scheduled through the SFA Counseling and Career Services office.

5. Grades for repeated courses will be averaged.

6. Completion of the following academic courses:

7. Core Curriculum Requirements (42 hours)

   A. Communication (6 hours)
      • Three hours from: ENG 131, 133H
      • Three hours from: COM 111, 170
   B. Mathematics (3 hours): Three hours: MTH 220
   C. Life and Physical Sciences (6 hours): Six hours from: BIO 238, CHE 111
   D. Language, Philosophy and Culture (3 hours)
      • Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H; HIS 151, 152; PHI 153, 223
   E. Creative Arts (3hours)
      • Three hours from: ART 280, 281, 282; DAN 140; MUS 140; MHL 245; THR 161, 163
   F. Social and Behavioral Sciences (3 hours): Three hours from: PSY 133
   G. Component Area Option (6 hours): including three hours: ENG 132
8. Applicant must submit official transcripts from all colleges to SFA Admissions Office and to NursingCAS.

9. Applications are submitted to NursingCAS (nursingcas.org).

Additional Requirements
A. Additional Requirements
   Academic courses required by the School of Nursing must include BIO 238L (A&P I Lab); CHE 111L (Introduction to Chemistry Lab); BIO 239 and 239L (A&P II and Lab); BIO 308 (Pre-nursing Microbiology); three or four hours from PSY 376, HMS 336, or HMS 236/236L (Child Development); NUR 304 (Pathophysiology); three hours from HMS 239 or 355 (Nutrition); and three hours from SOC 137 (Intorduction to Sociology), SOC 139 (Race and Ethnic

Relations) or ANT 231 (Cultural Anthropology).

B. A nursing major of at least 51 to 55 hours, including three hours of nursing electives.

C. Enough additional hours to make a total of at least 120 semester hours of acceptable credit

D. A minimum of 42 hours of residence work on SFA campus, of which 36 semester hours must be advanced 300-400 level courses

E. A maximum of 66 hours may be transferred from a junior college.

F. A grade of at least C in each freshman English course, a C average in coursework completed at SFA, a minimum of C in each course in the major field and specified cognates. These required averages are based upon those courses in each category included in the student's official degree plan.

G. Computer science, component area course, HIS 133 and 134, and PSC 141 and 142, are not required for entrance into the nursing program. However, they are required by the university for graduation.

A. Admission Process - Up to 80 students may be admitted each fall and spring semester based on completion of prerequisites and attainment of admission criteria. Admission is competitive based upon the applicant's overall and science grade-point averages, as well as the nursing entrance exam. To be considered for admission review, the student must be admitted to the university and complete the following application steps:

- Completed application to NursingCAS (nursingcas.org).

- Complete, official copies of transcripts from all previous colleges and SFA transcript to be submitted to NursingCAS.

- Copies of accepted or denied petitions or petitions being submitted to be sent to School of Nursing.

- Copy of nursing entrance test (Test of Essential Academic Skills, scheduled through the testing office) to be sent to the School of Nursing.

- Student essay submitted to NursingCAS.

- All science courses must be taken within the past seven years prior to admission to the nursing school.

B. Application Deadlines - The deadline for application for admission to the fall class is Feb. 1 each year. The deadline for the spring class is Aug. 15 each year. Applications received after these deadlines will be considered only if vacancies still exist in the incoming class. The School of Nursing recommends that applications be completed four to six weeks prior to the deadline. It is the responsibility of the student to make sure that all application materials are received by NursingCAS prior to the stated deadline. When students apply, prerequisites must be completed by the end of the semester in which the application is submitted. Applications are not retained from semester to semester. For a student to re-apply, the student must request that NursingCAS roll over the application to the next period.

Sciences and Mathematics

C. Eligibility - Any applicant who is not in good standing at another nursing program and is not eligible to continue or return to that program will be ineligible for admission into the School of Nursing program. If a student from another program has failed two or more nursing courses, that student will not be considered for admission. Criminal background checks will be conducted on all nursing students upon being accepted into the program. A positive background check shows the student was arrested, charged, and/or convicted of a crime. A positive background check may result in a student's inability to attend clinical classes until a declaratory order is obtained from the Texas Board of Nursing. Resulting time delays could affect student progress. If a student knows of a possible problem, the student should seek a declaratory order from the BON prior to or concurrent with application to the program.

D. Transfers - Students who have completed courses at other institutions may transfer credits under the policies of SFA. Nursing hours will be evaluated individually for transfer. Nursing courses are to be taken in order or concurrently within their block. Any exception will be the decision of the Student Affairs Committee and the director.

OTHER EXPENSES

Uniforms, shoes, name pin, stethoscope and health insurance are all purchased prior to the first nursing course. A urinalysis for drug screening must be submitted prior to the first nursing course. Other requirements include TdaP immunization, MMR immunization; HBV immunization (or serological confirmation of immunity); two doses of varicella vaccine (unless first dose was received prior to age 13); serologic confirmation of immunity of varicella disease; annual TB screening; meningitis vaccine; polio vaccine; flu shot (if required by clinical site); criminal background checks as required by Board of Nursing and the School of Nursing; and current American Heart Association BLS Healthcare Provider certification. If necessary, random drug screen costs will be incurred by the student. Traveling accommodations and expenses to clinical sites are the student's responsibility.

CURRICULUM

The curriculum of the School of Nursing allows for individual planning and is based on the mission statement and core values. The curriculum plan includes courses in general education, science and the humanities and a nursing core. The curriculum exposes students to each of the major practice areas of nursing; clinical practice aids in development of skill competencies.

The baccalaureate program is accredited by the Accreditation Commission for Education in Nursing (ACEN) and the Texas Board of Nursing. Upon successful completion, students may apply to take the state licensure exam.

Model Curriculum Outline: Students admitted to nursing program after fall 2009 (120 hours)

Freshman Year

BIO 238*	4	BIO 239*	4
ENG 131*	3	ENG 132*	3
PSY 133	4	HMS 239*	3
COM 111/COM 170	3	MTH 220	3
HIS 133	3	HIS 134	3
	16		**16**

Sophomore Year

CHE 111*	4	BIO 308*	4
NUR 304*	3	HMS 236/PSY 376/HMS 339*	3
ENG200-230/PHI 153/HIS 151	3	Creative Arts	3
SOC 137/SOC 139/ANT 231	3	CSC 101/121	3
Component Area Course	3		
	16		**13**

Summer Session

Complete PSC 141 and PSC 142 courses, if not completed.

Junior Year (25 hours)

NUR 305 (Intro to Nursing)	2	NUR 330 (Med-Surg I)	6
NUR 306 (Basic Care)	6	NUR 331 (W&C I)	4
NUR 307 (Assessment)	2	NUR 332 (Mental Health I)	2
NUR 308 (Pharmacology)	3	Nursing Elective	2
	13		**14**

Senior Year (26 hours)

NUR 406 (Med Surg II)	6	NUR 430 (Research & EBP)	3
NUR 407 (W&C II)	4	NUR 431 (Community)	4
NUR 408 (Mental Health II)	2	NUR 432 (Leadership)	4
Nursing Elective	1	NUR 433 (Capstone)	2
	13		**13**

Specified cognates must be completed with at least a grade of C for acceptance into the nursing program.

The Model Curriculum Outline can be manipulated to meet student needs. Some courses have specific prerequisites. For questions or concerns, consult your advisor.

Core electives:

Select one from Creative Arts*-3 hours. Select one from Language, Philosophy and Culture-3 hours**

ART 280, 281, 282	ENG 200, 233H, PHI 153, 223
MUS 140; MHL 245	
THR 161, 163	
DAN 140	

Select two from Component Area**-3 hour courses: ENG 132 is required; select one other course.

BCM 247	FRE 131, 132
COM 111, 170	POR 131, 132
ENG 273	SPA 131, 132
SPH 172, 272 (Sign Language)	GER 131, 132

Nursing Electives (three credit hours required): must be admitted to the SON to take nursing electives.

Refer to Prescribed Nursing Electives located at the end of this section.

COURSES IN NURSING
Nursing Curriculum

304. **Pathophysiology** - Three semester didactic hours. Provides initial foundation for core concepts of human pathophysiology upon which evidence-based nursing practice is founded. BIO 308 or 309 may be taken concurrently. Prerequisites: BIO 238, 239. Prerequisite or Co-requisite: BIO 308 or 309. Required incidental course fees.

305. **Introduction to Nursing** - Two semester didactic hours. Acquisition of nursing theory, history, nursing roles, ethics and the health care system. Addresses the process of critical thinking, nursing process, communication and mathematical strategies for medication dosages. Prerequisite: Admission to SON. Co-requisites: NUR 306, 307 and 308.

306. **Basic Nursing Care of Adult Clients** - Six semester hours, three hours didactic and nine hours clinical practicum (NURS 306P). Acquisition and application of nursing theory, research and practice to adult clients experiencing health care needs. Prerequisites: NUR 304, admission into nursing program. Co-requisites: NUR 305, 307, 308. Required incidental course fee. Note: If NUR 307 and/or NUR 308 is dropped, the student also must drop NUR 306.

307. **Assessment across the Lifespan** - Two semester hours, one hour didactic and three hours clinical practicum (NUR 307P). Acquisition and application of nursing assessment skills for clients throughout the lifespan to provide a basis for critical thinking and nursing practice decisions. Prerequisites: NUR 304 and admission into nursing program. Co-requisites: NUR 305, 306, 308. Required incidental course fee.

308. **Pharmacology across the Lifespan** - Three semester didactic hours. Establishes a foundation for the pharmacological aspects of nursing. Examines student readiness for clinical practicum with qualifying exam. Prerequisites: NUR 304 and admission to nursing program. Co-requisites: NUR 305, 306, 307. Required incidental course fee.

330. **Nursing Care of Young Adult to Elderly** - Six semester hours, three hours didactic and nine hours clinical practicum (NUR 330P). This course provides students the opportunity to apply critical thinking, nursing theory, research and practice to the care of adult clients. Emphasis is placed on care of the client with simple to complex health needs in a variety of health care settings. Prerequisites: NUR 305, 306, 307, 308. Co-requisites: NUR 331, 332. Required incidental course fee.

331. **Nursing Care of Women and Children I** - Four semester hours, two

hours didactic and six hours clinical practicum (NUR 331P). Students apply critical thinking, nursing theory, research and practice to issues of childbearing, childrearing and women's health. Growth and development, health promotion, and communication will be discussed. The role of the nurse and teaching are highlighted. Prerequisites: NUR 305, 306, 307, 308. Co-requisites: NUR 330, 332. Required incidental course fee.

332. **Nursing Care in Promotion of Mental Wellness** - Two semester hours, one hour didactic and three hours clinical practicum (NUR 332P). Application of nursing theory, research and practice to clients experiencing mental health stressors with emphasis on primary prevention, communication and self-awareness. Prerequisites: NUR 305, 306, 307, 308. Co-requisites: NUR 330, 331. Required incidental course fee.

406. **Nursing Care of Complex Health Needs** - Six semester hours, three hours didactic and nine hours clinical practicum (NUR 406P). This course provides students the opportunity to apply critical thinking, nursing theory, research and practice to acutely ill clients of diverse spiritual, ethno-cultural and socioeconomic backgrounds in a variety of clinical settings. Emphasis is placed on meeting needs of acutely ill clients and nurse's role in addressing legal, ethical and economic issues within the interdisciplinary health care team. Prerequisites: NUR 330, 331, 332. Co-requisites: NUR 407, 408. Required incidental course fee.

407. **Nursing Care of Women and Children II** - Four semester hours, two hours didactic and six hours clinical practicum (NUR 407P). Course builds upon Women and Children I and previous, concurrent and prerequisite courses. Emphasis on critical thinking, nursing theory, research and practice with clients from birth to adolescence, and women and their families in the intrapartum and postpartum periods. Acute and complex health needs will be explored. Care of the high-risk family, labor, birth, role of the nurse and teaching are highlighted. Prerequisites: NUR 330, 331, 332. Co-requisites: NUR 406, 408. Required incidental course fee.

408. **Nursing Care Clients Complex Mental Health Needs** - Two semester hours, one hour didactic and three hours clinical practicum (NUR 408P). Builds on NUR 332. Application of nursing theory, research and practice to families and clients experiencing complex mental health needs. Emphasis on nurse's role on interdisciplinary health care team. Prerequisites: NUR 330, 331, 332. Co-requisites: NUR 406, 407. Required incidental course fee.

430. **Nursing Research and Application** - Three semester hours, two hours didactic and three hours clinical practicum (NUR 430P). Introduction of concepts and process of research in nursing with an emphasis on the techniques for critiquing published research studies and development of ability to use nursing and interdisciplinary research to guide nursing practice. Prerequisites: NUR 406, 407, 408. Co-requisites: NUR 431, 432, 433. Required incidental course fee.

Sciences and Mathematics

431. **Nursing Care of Community Populations** - Four semester hours, two hour didactic and six hours clinical practicum (NUR 431P). Application of nursing theory, research and practice to community populations with focus on health promotion, prevention of illness, and the impact of situational and developmental stressors on social units. Prerequisites: NUR 406, 407, 408. Co-requisites: NUR 430, 432, 433. Required incidental course fee.

432. **Leadership/Coordination of Nursing** - Four semester hours, two hour didactic and six hours clinical practicum (NUR 432P). Students apply critical thinking, management, leadership and nursing theories and research while coordinating nursing care of multiple clients. The role of the nurse as a leader and manager within the interdisciplinary health care team and system will be emphasized. Prerequisites: NUR 406, 407, 408. Co-requisites: NUR 430, 431, 433. Required incidental course fee.

433. **Nursing Capstone** - Two semester hours (six hours clinical practicum). Designed to strengthen student readiness to practice as an entry-level nurse. Students will apply critical thinking, nursing theory, research and practice to clinical decision-making with clients of diverse spiritual, ethnic, cultural and socioeconomic backgrounds. Prerequisites: NUR 406, 407, 408. Co-requisites: NUR 430, 431, 432. Required incidental course fee.

Nursing Elective Course Selections
Both generic BSN students and RN-BSN students may take the following according to listed prerequisites:

340. **Communication in Health Care** - Two semester hours, two hours didactic. Theory and practice of professional communication in health care settings, with emphasis on the study of perception, emotions, nonverbal and verbal communication, assertiveness, conflict resolution and interpersonal relationships. Teaching strategies used by nurses as leader and facilitator on the interdisciplinary health care team are emphasized. Prerequisite: admission to SON.

343. **Women's Health Issues** - Two semester didactic hours. Familiarizes the student with women's health issues across the lifespan, using feminist thought to identify issues related to American women's health. Prerequisite: admission to SON.

350. **History of the Nursing Profession** - One semester hour didactic course. Identify historical figures and trends in nursing that influence nursing care. Discuss historical accounts in nursing. Prerequisite: admission to SON.

351. **Current Issues and Trends in Nursing** - One semester hour, one hour didactic. Students apply critical thinking, nursing theory, research and practice to current issues affecting the nurse in political, economic, cultural, workplace and alternative-healing settings. Introduction to emergency preparedness for the nurse, workplace advocacy and nursing informatics. Prerequisite: admission to SON.

352. **Ethics in Nursing** - One semester didactic hour. Provides the opportunity for critical thinking and the acquisition and application of ethical decision-making models and theories to ethical issues across the

curriculum and the lifespan. The role of the nurse as an integral part of the interdisciplinary ethical decision-making team is highlighted. Prerequisites: must be a third- or fourth-semester nursing student or a RN Transition student.

353. **Complementary and Alternative Therapies (CAT)** - One semester didactic hour. Introduces selected complementary and alternative therapies cited in health care literature, critically evaluating these complementary and alternative therapies for potential benefit in maintaining and improving health. Incorporates current evidence and efficacy relating to use and safety of complementary and alternative therapies. Prerequisite: admission to SON.

354. **Healthy Aging** - Two hour didactic content related to issues concerning aging and the elderly. Emphasis will be placed on physical changes and factors influencing healthy aging, such as nutrition, medications, activity and community resources available to families with an aging member. Also covers death and dying, medical power of attorney, living wills and insurance benefits. Prerequisite: admission to SON.

355. **Child Health Issues -** Two semester didactic hours. Provides student the opportunity to explore current and historical health care topics that have a significant impact on newborns, infants, children, and adolescents of today. Historical, legal, ethical, cultural and socioeconomic influences affecting children and families will be discussed with an emphasis on health promotion and preventative care. Prerequisite: admission to SON.

356. **Birthing Practices in the U.S. and Beyond -** Two credit didactic hours. Provides students the opportunity to explore historic and current birth practices in the U.S. and globally. Students will compare perinatal, infant, and maternal mortality rates in various countries, and consider potential causes, including socioeconomic, ethnocultural, and health care delivery issues. Prerequisite: admission to SON.

358. **Exploring Grief -** One semester didactic hour. Provide an overview of the issues associated with grief and grieving. The focus will be on ethnocultural and spirtual perspectives. Students will reflect on death, dying, grief and loss. Course will assist nurses to identify therapeutic communication strategies and skills required to meet the needs of those experiencing grief or loss. Prerequisite: must be a second, third, or fourth semester student, or a RN transition student.

451. **Violence in Families** - Two semester didactic hours. Provides the opportunity for critical thinking and the acquisition and application of nursing and interdisciplinary theories, research and practice to issues related to violence against dating/intimate partners, children and the elderly. The role of the nurse as an integral part of the interdisciplinary team is highlighted. Prerequisite: admission to SON.

452. **Perioperative Nursing** - Two semester didactic hours. Provides the opportunity to apply critical thinking, nursing theory, research and practice to specific perioperative concepts and situations. Varied roles of the nurse in the perioperative area will be explored as well as the role of the nurse in the interdisciplinary team. Prerequisite: must be a third- or fourth-semester nursing student or an RN Transition student.

Sciences and Mathematics

453. **Jurisprudence -** One semester didactic hour. Teaches the legal issues affecting the nursing profession today and prepares nursing students for the required state nursing jurisprudence examination. The course will prepare students to problem solve legal and ethical issues. The course focuses on nursing application of management skills, decision-making process, problem-solving and advanced legal knowledge within the nursing profession. Prerequisites: must be a third- or fourth-semester nursing student or an RN Transition student.

454. **Clinical Aromatherapy for Nurses -** Two semester didactic hours. This course will introduce the student to the study of clinical aromatherapy for nurses. The student will examine the principles, practices and outcomes of essential oils used in complementary and alternative therapies. The influences of diverse cultural groups, history and safety of aromatherpy, as well as evidence-based research are examined in relationship to healing mind, body and spirit using essential oils. Prerequisite: admission to SON.

RN-BSN ONLINE TRANSITION TRACK

The School of Nursing at SFA encourages nurses who have completed their nursing education in either an associate degree or diploma program to obtain the baccalaureate degree in nursing. The RN-BSN Online Transition track was established for the student who has previously passed the NCLEX-RN and has current licensure as a registered nurse and wishes to obtain the baccalaureate degree. The RN-BSN track courses are online.

RN-BSN Online Transition Admission Policy

A student requesting admission to the baccalaureate program in nursing must meet the following criteria:

Full Admission

1. Acceptance to SFA.
2. Current licensure to practice as a registered nurse and working as a registered nurse.
3. Overall GPA of 2.5 in prerequisite courses, including transfer courses.
4. Completed application to NursingCAS RN-BSN Track (nursingcas.org).
5. The following academic courses must be completed prior to admission to the RN BSN Track of the School of Nursing:

1. Core Curriculum Requirements (42 hours)
  A. Communication (6 hours)
   • Three hours from: ENG 131, 133H
   • Three hours from: COM 111, 170
  B. Mathematics (3 hours): Three hours from: MTH 220
  C. Life and Physical Sciences (6 hours): Six hours from: BIO 238, CHE 111
  D. Language, Philosophy and Culture (3 hours)
   • Three hours from: ENG 200, 209, 211, 212, 221, 222, 229, 230, 233H; HIS 151, 152; PHI 153, 223
  E. Creative Arts (3hours)
   • Three hours from: ART 280, 281, 282; DAN 140; MUS 140; MHL 245; THR 161, 163
  F. American History (6 hours)
   • Six hours from U.S. history (with Texas option): HIS 133, 134
  G. Government/Political Science (6 hours): Six hours: PSC 141, 142

H. Social and Behavioral Sciences (3 hours): Three hours from: PSY 133
I. Component Area Option (6 hours)
  • Three hours: ENG 132
  • Three hours from: BCM 247; ENG 273: FRE 131, 132: GER 131, 132; POR 131, 132; SPA 131, 132: SPH 172, 272

Additional Requirements

1. Academic courses required by the School of Nursing must include BIO 238L (A&P I Lab); CHE 111L (Introduction to Chemistry Lab); BIO 239 and 239L (A&P II and Lab); BIO 308 (Pre-nursing Microbiology); three or four hours from PSY 376, HMS 336, or HMS 236/236L (Child Development); NUR 304 or NUR 438 (Pathophysiology); three hours from HMS 239 or 355 (Nutrition). In addition to the additional requirements, three hours of nursing electives may be required prior to graduation.

2. Enough additional hours to make a total of at least 120 semester hours of acceptable credit.

3. A minimum of 30 hours of residence work on the SFA campus, all of which must be advanced 300-400 level courses.

4. A grade of at least C in each freshman English course, a C average in coursework completed at SFA, a minimum of C in each course in the major field and specified cognates. These required averages are based upon those courses in each category included in the student's official degree plan.

History and political science courses are not required for entrance into the nursing program. However, they are required by the university for graduation.

Admission Process – Students may be admitted based on completion of prerequisites and attainment of admission criteria. When spaces are limited, admission of qualified applicants will be processed in the order received. To be considered for admission, the student must complete the following:

• Completed application to NursingCAS (nursingcas.org)

• Complete, official copies of transcripts from all previous colleges and SFA transcript to be submitted to NursingCAS

• Copies of accepted or denied petitions or petitions being submitted to be sent to School of Nursing;

• Copy of current licensure to practice as a registered nurse.

Application Deadline – The deadline for application for admission is June 1 each year. Applications received after this deadline will be considered only if vacancies still exist in the incoming class. It is the responsibility of the student to make sure all application materials are received by the NursingCAS system and the School of Nursing prior to the deadline.

Students who have completed courses at other collegiate institutions may transfer credits under the policies of SFA. A maximum of 66 academic semester hours may be transferred from a junior college. There is no limit to the number of senior college hours that may be transferred; however, 30 hours, all of which are advanced (300-499 level), must be completed in residence at SFA. Advanced Placement credit does not count as hours toward residency.

Sciences and Mathematics

436. **RN-BSN Pharmacology (Web-based)** - Three semester didactic hours. Establishes a foundation for the pharmacological aspects of nursing. Prerequisites: RN license, BIO 238 and BIO 239. Schedule varies; please consult with advisor or RN Transition Track coordinator. Required incidental course fees.

437. **RN-BSN Health Assessment (Web-based)** - Two semester hours, one hour didactic and three hours clinical practicum (NUR 437P). Acquisition and application of nursing assessment skills for clients throughout the lifespan to provide a basis for critical thinking and nursing practice decisions. Prerequisites: RN license, NUR 434 and NUR 435. Schedule varies; please consult with advisor or RN Transition Track coordinator. Required incidental course fees.

438. **RN-BSN Pathophysiology (Web-based)** - Three semester didactic hours. Provides foundation for core concepts of human pathophysiology upon which evidence-based nursing practice is founded. Prerequisites: RN license, BIO 238, BIO 239 and permission of instructor. Schedule varies; please consult with advisor or RN Transition Track coordinator. Required incidental course fees.

439. **RN-BSN Research and Application (Web-based)** - Three semester hours, two hours didactic and three hours clinical practicum (NUR 439P). Introduction of concepts and process of research in nursing with an emphasis on the techniques for critiquing published research studies and development of ability to use nursing and interdisciplinary research to guide nursing practice. Prerequisites: RN license, MTH 220; NUR 434 and NUR 435.

440. **RN-BSN Care of Community Populations (Web-based)** - Four semester hours, two hour didactic and six hours clinical practicum (NUR 440P). Application of nursing theory, research and practice to community populations with focus on health promotion, prevention of illness and the impact of situational and developmental stressors on social units. Prerequisites: RN license, NUR 434 and NUR 435. Required incidental course fees.

441. **RN-BSN Leadership (Web-based)** - Four semester hours, two hour didactic and six hours clinical practicum (NUR 441P). Students apply critical-thinking management, leadership and nursing theories, and research while coordinating nursing care of multiple clients. The role of the nurse as a leader and manager within the disciplinary health care team and system will be emphasized. Prerequisites: RN license, NUR 434 and 435. Pre- or co-requisite: NUR 440.

442. **RN-BSN Transition (Web-based)** - Three semester hours. This course builds upon principles and theories from previous, concurrent and prerequisite courses. This course prepares the licensed registered nurse to transition from ADN to BSN. Students will have the opportunity for acquisition and application of nursing history, theory, research and practice as a BSN. Students also analyze current trends and issues in nursing, health care and impact on the role of the BSN. Prerequisites: admission to RN-BSN Track. Required incidental course fees.

443. **RN-BSN Legal and Ethical Issues in Professional Nursing (Web-based)** - Three semester didactic hours. This course builds upon principles and theories from previous, concurrent and prerequisite courses. This course provides students the opportunity to improve nursing practice and patient outcomes through the use of nursing informatics. Prerequisites: admission to RN-BSN Track or permission of instructor.

444. **RN-BSN Cultural Issues in Professional Nursing (Web-based)** - Three semester didactic hours. This course builds upon principles and theories from previous, concurrent and prerequisite courses. This course focuses on culture and its impact on health care delivery at the individual, community and system levels. This course is designed to raise awareness, to inspire action and to open discussion of cultural issues affecting professional nursing practice. Prerequisites: admission to RN-BSN Track or permission of instructor.

445. **RN-BSN Nursing Informatics (Web-based)** - Three semester didactic hours. This course builds upon principles and theories from previous, concurrent and prerequisite courses. This course provides students the opportunity to improve nursing practice and patient outcomes through the use of nursing informatics. Prerequisites: admission to RN-BSN Track or permission of instructor.

Suggested Program of Study
Sequence may vary due to courses offered

NUR 437 RN-BSN Health Assessment (Two hours)
NUR 438 RN-BSN Pathophysiology (Three hours)
NUR 439 RN-BSN Research (Three hours)
NUR 442 RN-BSN Transition (Three hours)
NUR 436 RN-BSN Pharmacology (Three hours)
NUR 440 RN-BSN Care of Community Populations (Four hours)
NUR 441 RN-BSN Leadership (Four hours)
NUR 444 Cultural Issues in Professional Nursing (Three hours)
NUR 445 Nursing Informatics (Three hours)
NUR 443 Legal and Ethical Issues in Professional Nursing (Three hours)

Prescribed Nursing Electives (if needed to meet 31 hours):
NUR 340   Communication in Health Care, two hours
NUR 343   Women's Health Issues, two hours
NUR 350   History of the Nursing Profession, one hour
NUR 351   Current Issues and Trends in Nursing, one hour
NUR 352   Ethics in Nursing, one hour
NUR 353   Complementary and Alternative Therapies, one hour
NUR 354   Healthy Aging, two hours
NUR 355   Child Health Issues, two hours
NUR 356   Birthing Practices in U.S. and Beyond, two hours
NUR 358   Exploring Grief, one hour
NUR 451   Violence in Families, two hours
NUR 452   Perioperative Nursing, two hours
NUR 453   Jurisprudence, one hour
NUR 454   Clinical Aromatherapy for Nurses

The DeWitt School of Nursing is accredited by the Accreditation Commission for Education in Nursing
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All School of Nursing information is available online at nursing.sfasu.edu/nursing. Specific helpful links are Admission Process and Brochures.

DEPARTMENT OF PHYSICS, ENGINEERING AND ASTRONOMY

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AREAS OF STUDY AND DEGREE

B.S. Physics
B.S. Engineering Physics

Minors:
Physics
Astronomy
Engineering

FACULTY

Regents Professors
 Thomas O. Callaway (1998 - 1999)
 Harry D. Downing (2013 - 2014)
 Norman L. Markworth (2000 - 2001)
Professor
 W. Dan Bruton
Associate Professors
 Robert B. Friedfeld, Joseph A. Musser, Walter L. Trikosko
Assistant Professors
 James T. Adams, Christopher J. Aul, Hector A. Ochoa
Lecturers
 Edward J. Michaels, Ali A. Piran

OBJECTIVES

The courses in physics, engineering and astronomy are designed to acquaint students with the general all-embracing principles that are the foundations of the present understanding of physics, astronomy and engineering, and to furnish experiences in lecture and laboratory that will develop scientific attitudes, insights and techniques. The department seeks to prepare students for graduate study or to provide students preparing to teach at the pre-college level with a background appropriate with their needs; to provide students with the physics and engineering background required for work in engineering, related sciences and medicine; and to assist non-science majors in developing an insight into the physical aspects of our environment and the extensive scientific activity of our society.

PHYSICS MAJOR

Programs for physics majors vary with the student's goals and interests. The recommended curriculum for the student preparing for graduate study in physics or employment as a professional physicist is detailed below. Students interested in both physics and engineering may wish to consider the physics-engineering dual degree program or engineering physics program described on the following page. The minimum course requirements for a major in physics consist of 37 hours of physics, astronomy and engineering, of which 26 hours must be advanced. This must include PHY 241, 242, 321 (or EGR 321), 333, 347, 430, 431, 440, 441 and 470, plus three hours from PHY 250 (or EGR 250), 262 (or EGR 215), 343 (or EGR 343), AST 305 or 335, or special problems (PHY 475 or 476). CHE 133 and 134 also are required.

Engineering Physics Major

The engineering physics program is the study of the combined disciplines of physics, engineering and mathematics in order to develop an understanding of the interrelationships of these three disciplines. The educational objective is to address the needs of students seeking innovative careers in high-tech areas where multiple engineering disciplines merge (e.g. electro-mechanical industries). The majority of graduates of the program enter industry in diverse areas such as mechanical controls, digital and analog electronics, nuclear instrumentation, software development, and manufacturing process control. Others choose to attend graduate school in either engineering or physics programs.

Pre-Engineering

Students wishing to major in any of the many branches of engineering may take their first two years in pre-engineering at SFA and transfer to a college of engineering for their final two years to complete their course of study.

Dual Degree

The physics-engineering dual degree program provides an option through which SFA students may complete requirements for a major in physics, a minor in mathematics and the core of courses that are part of the pre-engineering program. Students who complete the dual degree curriculum outlined below will receive a B.S. in physics from SFA upon transferring back sufficient semester hours (approximately 30) from the upper-division engineering program. (Of these 30 hours, six hours must be advanced engineering hours. The remainder may be core courses and electives.) Upon completion of the engineering program, the student will receive a B.S. in engineering.

Students in any of these programs should consult with their advisors to adjust the programs outlined below to meet the variations in requirements particular to the branch of engineering and the terminal university.

Physics Minor

The requirements for a minor in physics are 18 semester hours and must include PHY 241 (or 131 with department permission), 242 (or 132 with department permission), and 333 plus six hours (two must be advanced) from the following courses: PHY 110, 250 (or EGR 250), 321 (or EGR 321), 262 (or EGR 215), 343 (or EGR 343), 347, 430, 431, 440, 441, 470, 475 (or 476) or AST 105, 305 or 335. All programs must be approved on the degree plan by the chair of the department. Majors, minors and those seeking teacher certification should consult with an advisor in the Department of Physics, Engineering and Astronomy at their earliest opportunity to plan their program with the proper sequencing of courses.

Astronomy Minor

The astronomy minor has been developed for students who have interests in astronomy beyond the introductory level. The course of study includes introductory physics, introductory astronomy, observational astronomy and astrophysics. A student majoring in physics may minor in astronomy, but courses that are applied to the minor cannot be applied to the major at the same time unless the student has a second minor from a different department.

The requirements for the minor in astronomy are PHY 241 (or 131 with department permission), 242 (or 132 with department permission), AST 105, 305 and 335. All minor programs must be approved on the degree plan by the chair of the department.

Engineering Minor (18 hours)
The engineering minor includes courses in introductory engineering, statics, dynamics, electrical circuits and devices, and digital systems. This minor can prepare students for employment or continued study in the areas of mechanical, electrical and civil engineering. (This minor does not qualify a student to take the professional engineering exam.)

A minor in engineering requires a minimum of 18 hours of engineering course work. The requirements for the minor in engineering are EGR 111 or 112, 215, 250, 321 and 343. All minor programs must be approved on the degree plan by the chair of the department.

A student majoring in physics may minor in engineering, but courses that are applied to the minor cannot be applied to the major at the same time unless the student has a second minor from a different department.

Teacher Certification Programs
Requirements for certification in the physical sciences are listed in the Teacher Certification section of this bulletin.

PHYSICS FRESHMAN SCHOLARSHIPS AND FINANCIAL AID
In addition to those opportunities provided through the Office of Student Financial Assistance, the Department of Physics, Engineering and Astronomy offers a number of scholarships to well-qualified students majoring in physics or engineering physics. Inquiries regarding scholarships should be directed to the chair of the physics, engineering and astronomy department. Beginning freshmen are advised to make application for a scholarship during their senior year in high school. Part-time employment opportunities within the department are usually available to physics majors and minors, astronomy minors, engineering physics majors, and engineering minors who have completed, with good academic records, a portion of their physics, astronomy and engineering courses.

STUDENT ORGANIZATIONS
The Society of Physics Students at SFA has been extremely active since the 1970s. The club is a support organization involved with activities that serve the department, the university and the local public. These activities include public viewing sessions at the SFA Observatory, STEM Day and Physics Magic Shows for underprivileged children. Since 1990, the club has won 23 national Outstanding Chapter awards. Twelve to 16 students each semester attend SPS Zone 13 meetings held in conjunction with the Texas Sections of the American Association of Physics Teachers and the American Physical Society.

The Engineering Student Organization was started in 2015 alongside the new engineering physics degree offered at SFA. This is a group of individuals who share an interest in engineering and participate in engineering projects stemming from the department, university and in public outreach settings. Activities include involvement with major engineering societies' project-based competitions, like those held by the American Society of Mechanical Engineers and the Institute of Electrical and Electronics Engineers. The organization also is home to student-led projects, study groups for engineering courses and opportunities to interact with faculty members on research endeavors.

RECOMMENDED CURRICULUM FOR MAJORS IN PHYSICS

During the summer prior to beginning the program outlined below, students unprepared for MTH 233 are encouraged to enroll for preparatory mathematics courses equivalent to MTH 133, 138 and 139. Students who cannot obtain the preparatory mathematics before beginning this program may, in consultation with the physics faculty, work out an alternate plan, that leads to the B.S. degree with a major in physics.

Students majoring in physics regularly minor in mathematics. Many elect to pursue a double major in physics and mathematics. The following recommended curriculum includes courses meeting the requirements for a major in physics and a minor in mathematics. To obtain a double major in physics and mathematics, students should take additional mathematics courses in place of electives to meet the requirements listed in the Department of Mathematics and Statistics.

Major in Physics, Minor in Mathematics (120 hours)

Recommended Curriculum For Professional Physics Option

Freshman Year (29-30 hours)

PHY 108	3	*PHY 241	4
CHE 133	4	CHE 134	4
MTH 233	4	MTH 234	4
Required English	3	Required English	3
	14		**15**

Sophomore Year (32 hours)

*PHY 242	4	PHY 321	4
MTH 333	4	CSC 102	3
HIS 133	3	HIS 134	3
Elective	3	Core Req.	6
	14		**16**

Junior Year (31-33 hours)

PHY 333	4	PHY 430 or 441	3-4
PSC 141	3	PSC 142	3
MTH 317	3	MTH 337	3
Core Req.	3	Core Req.	3
Elective	3	Elective	3
	16		**15-16**

Senior Year (25-28 hours)

PHY 347	3	PHY 440	3
PHY 431	3	PHY 430 or 441	3-4
Core Req.	3	PHY 470	2
Electives	6	Electives	6
	15		**14-15**

For the electives listed, three to four hours must be department electives from PHY 250, 262, 343, 475, 476, AST 305 or 335.

*Not open to students with junior and senior physics major or minor standing without approval of the chair of the department.

COURSE CREDIT

Unless otherwise indicated, courses are three-semester hours credit, three hours lecture per week.

CO-REQUISITE AND PREREQUISITE COURSES

Physics, astronomy and engineering courses that are co-requisites must be taken together during the same semester. Separate grades will be awarded for these courses unless otherwise specified in the course description. Withdrawal from one co-requisite course requires the dropping of the other course. A student is not required to repeat a co-requisite course for which he/she has received a passing grade.

A minimum grade of C or departmental approval is required in all prerequisite courses to a physics, astronomy or engineering course.

COURSES IN PHYSICS (PHY)

101. **General Physics I - (PHYS 1305)** - Presentation with a minimum of mathematics of the basic concepts of mechanics, light and sound. May not be used to meet graduation requirements by students majoring in the College of Sciences and Mathematics (except for students majoring in Computer Information Systems or Information Technology). Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 101L.

101L. **General Physics I Laboratory - (PHYS 1105)** - One semester hour, two hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 101. Lab fee required.

102. **General Physics II - (PHYS 1307)** - Continuation of PHY 101; presenting with a minimum of mathematics the basic concepts of heat, electricity, magnetism and certain aspects of modern physics. May not be used to meet graduation requirements by students majoring in the College of Sciences and Mathematics (except for students majoring in Computer Information Systems or Information Technology). Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 102L.

102L. **General Physics II Laboratory - (PHYS 1107)** - One semester hour, two hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 102. Lab fee required.

108. **Introduction to Engineering/Physics** - Three semester hours, two hours lecture and two hours lab per week. Introductory course on engineering/physics analysis with practice in analyzing and solving problems in physics and engineering. Includes use of computational devices and methods. Lab fee required. Prerequisite: MTH 138 or department permission.

110. **Fundamentals of Electronics** - Introductory study of fundamental electrical circuits, including DC and AC circuits, filter networks, amplifiers, diodes, transistors, and logic gates. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 110L.

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110L. Fundamentals of Electronics Laboratory - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 110. Lab fee required.

118. Acoustical Physics - Three semester hours, two hours lecture, two hours lab per week. Topics covered include waves, resonance, frequency, pitch, waveform, hearing, intervals, scales, strings, air columns, rods, plates, vocal apparatus and instruments. Lab fee required.

131. Mechanics and Heat (PHYS 1301) - Fundamental principles of mechanics and heat. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Prerequisites: MTH 138 or department permission. Co-requisite: PHY 131L.

131L. Mechanics and Heat Laboratory (PHYS 1101) - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 131. Lab fee required.

132. Electricity, Sound and Light (PHYS 1302) - Basic electrical and magnetic phenomena, wave motion, sound and light. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Prerequisite: PHY 131. Co-requisite: PHY 132L.

132L. Electricity, Sound and Light Laboratory (PHYS 1102) - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 132. Lab fee required.

214. Selected Topics - Non-advanced. One to four hours. Material covered will vary from semester to semester and will be announced. May be repeated for additional credit in a different topic.

241. Technical Physics I (PHYS 2325) - Presentation of the principles of mechanics and heat. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Prerequisite: MTH 233 or concurrent enrollment. Co-requisite: PHY 241L.

241L. Technical Physics I Laboratory (PHYS 2125) - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 241. Lab fee required.

242. Technical Physics II (PHYS 2326) - Presentation of the principles of sound, electricity, magnetism and optics. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Prerequisites: PHY 131 or 241; MTH 234 or a B or better in MTH 233. Co-requisite: PHY 242L.

242L. Technical Physics II Laboratory (PHYS 2126) - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 242. Lab fee required.

250. **Engineering Statics** - Four semester hours, three hours lecture, three hours lab per week. Prerequisites: PHY 131 or 241 and MTH 234 or permission of instructor. (Same as EGR 250.) Lab fee required.

262. **Electrical Circuits and Devices** - Basic AC, DC and digital circuits and their applications in instrumentation. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Prerequisite: MTH 233. Co-requisite: PHY 262L (Same as EGR 215.)

262L. **Electrical Circuits and Devices Laboratory** - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 262. Lab fee required. (Same as EGR 215L.)

315. **A, B. Selected Topics** - One to four hours. Material covered varies from semester to semester and will be announced. May be repeated for additional credit in a different topic. Prerequisite: eight hours from any of the sciences.

321. **Engineering Dynamics** - Four semester hours, three hours lecture, three hours lab per week. Prerequisites: MTH 234 and PHY 131 or 241. (Same as EGR 321). Lab fee required.

333. **Modern Physics** - Introduction to relativity, quantum phenomena, atomic and nuclear physics. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Prerequisites: MTH 234 and PHY 132 or 242. Co-requisite: PHY 333L.

333L. **Modern Physics Laboratory** - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: PHY 333. Lab fee required.

343. **Electronics** - Three semester hours, two hours lecture, three hours lab per week. Design and integration of basic circuits into electronic instrumentation. Prerequisite: PHY 262 or EGR 215 or permission of instructor. Lab fee required. (Same as EGR 343.)

347. **Mathematical Applications in Physics I** - Formulation and solution of physical problems using vector analysis, partial differential equations, complex variables and transforms. Prerequisites: MTH 234 and PHY 132 or 242; and junior or senior major status.

410. **Experimental Techniques of Physics** - Four semester hours, three hours lecture and two hours lab per week. Presentation of the experimental techniques used to measure the physical observables associated with matter, mechanics, waves, sound, light, electricity and magnetism. Lab fee required.

430. **Thermodynamics** - Includes the kinetic theory of gases, Maxwell-Boltzmann statistics, Fermi-Dirac statistics, the Debye Approximation, magnetic cooling and the theory of heat engines. Prerequisites: PHY 333 and MTH 333.

431. **Introductory Quantum Mechanics** - DeBroglie wave, Schroedinger formulation, step and barrier potentials, perturbation theory, harmonic oscillator, annihilation and creation operations, commutation relations,

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representations. Prerequisite: MTH 333, PHY 333, 347 or permission of instructor.

440. **Introduction to Electricity and Magnetism** - Electrical and magnetic field theory, properties of dielectrics and magnetic materials. Prerequisites: MTH 333 and PHY 347.

441. **Optics** - Four semester hours, three hours lecture, three hours lab per week. Fundamentals of physical and geometrical optics, including polarization and diffraction. Prerequisites: PHY 440 and MTH 333 or permission of instructor. Lab fee required.

470. **Undergraduate Research and Technical Presentations** - Two semester hours. An individual instruction course involving undergraduate research and technical presentations. The purpose of this course is to give the student experience in research and preparation of oral presentations on scientific research. Prerequisite: senior major status.

475. **Special Problems** - One to four hours. For undergraduate credit only. Experimental or theoretical independent study in research. Prerequisites: 12 semester hours of physics and permission of instructor.

476. **Special Problems** - One to four hours. For undergraduate credit only. A continuation of PHY 475. Prerequisites: 12 semester hours of physics and permission of instructor.

485. **Internship in Physics and Engineering** - One to three hours. Supervised on-the-job training in one or more facets of the field of physics or engineering. Internships are to be arranged by students and approved by instructor. This course is an elective and cannot be used to satisfy any of the course requirements for a major or minor in physics.

*May be offered as an internet course.

Major in Engineering Physics (120 hours)

Freshman Year (33 hours)

EGR 111	3	EGR 112	3
MTH 140	4	MTH 233	4
PHY 108	3	PHY 241	4
HIS 133	3	HIS 134	3
Req. English	3	Req. English	3
	16		**17**

Sophomore Year (32 hours)

PHY 242	4	EGR 215	4
MTH 234	4	MTH 333	4
PSC 141	3	PSC 142	3
CSC 102	3	CHE 133	4
Core Req.	3		
	17		**15**

Junior Year (28 hours)

EGR 250	4	EGR 321	4
PHY 347	3	MTH 337	3
PHY 333	4	PHY 440	3
CHE 134	4	Core Req.	3
	15		**13**

Senior Year (28 hours)

Emphasis Course #1	3	Emphasis Course #3	3
Emphasis Course #2	3	Emphasis Course #4	3
EGR 343	3	EGR 470	2
EGR 460	2	ENG 273	3
Core Req.	3	Core Req.	3
	14		**14**

Students may choose one of the following emphasis tracks for their senior year:

Mechanical Engineering Emphasis Courses

AGM	325	Computer Aided Drafting
EGR	305	Mechanics of Materials
EGR	345	Fluid Mechanics
PHY	430	Thermodynamics

Electrical Engineering Emphasis Courses

EGR	314	Control Systems
EGR	344	Microcomputer Interfacing
EGR	370	Linear Circuit Analysis
PHY	441 or 431	Optics or Quantum Mechanics

*Note: Students who are qualified to take calculus their first semester at SFA can choose to replace MTH 140 and PHY 108 with other courses to bring the degree total to 120 credit hours. Students are encouraged to take math and chemistry courses during the summer to reduce fall and spring semester loads and to decrease the time required for a degree.

Pre-Engineering Curriculum

Freshman Year (33 hours)

PHY 108	3	PHY 241	4
MTH 233	4	MTH 234	4
EGR 111	3	EGR 112	3
HIS 133	3	HIS 134	3
Required English	3	Required English	3
	16		**17**

Sophomore Year (32 hours)

EGR 250	4	EGR 215	4
PHY 242	4	EGR 321	4
MTH 333	4	CSC 102	3
*Elective or Political Sci	3	*Elective or Political Sci	3
		Core Req.	3
	15		**17**

Summer Sessions

MTH 337, CHE 133 and 134 and *Electives, history or political science

Physics-Engineering Dual Degree Curriculum

Freshman Year (33 hours)

PHY 108	3	PHY 241	4
MTH 233	4	MTH 234	4
EGR 111	3	EGR 112	3
Required English	3	Required English	3
HIS 133	3	HIS 134	3
	16		**17**

Sophomore Year (32 hours)

EGR 250	4	EGR 215	4
PHY 242	4	EGR 321	4
MTH 333	4	CSC 102	3
PSC 141	3	PSC 142	3
		Core Req.	3
	15		**17**

Junior Year (33 hours)

PHY 347	3	PHY 440	3
PHY 333	4	MTH 337	3
MTH 317	3	Core Req.	3
Core Req.	3	Core Req.	3
*Electives or Core Req.	3	*Electives	3
		PHY 470	2
	16		**17**

Summer Sessions

CHE 133, 134 and required social science

*Students pursuing the specific engineering degree may include the following among their electives:
- Petroleum Engineer: GOL 131, 132
- Chemical Engineer: CHE 231, 331, 332
- Biochemical Engineer: BIO 131, 133; CHE 231, 331, 332

Students should contact terminal engineering schools about the compatibility of the above-suggested curriculum with their program.

COURSES IN ENGINEERING (EGR)

Unless otherwise indicated, courses listed below are three-semester hours credit, three hours lecture per week.

111. Foundations in Engineering I - Three semester hours, two hours lecture, two hours lab per week. Introduction to the engineering profession, ethics and disciplines; development of skills in teamwork, problem solving, logic processing, algorithm development, estimation, design and drawing; emphasis on computer applications and design. Software used: Microsoft Office and Windows, AutoCAD and the Internet. Lab fee required.

112. **Foundations in Engineering II** - Three semester hours, two hours lecture, two hours lab per week. Development of skills in problem solving, design, analysis, estimation and teamwork; utilization of computer tools for documentation and presentation; introduction to logic processing and computer programming; introduction to accounting and conservation principles in engineering. Software used: Microsoft Office and Windows, AutoCAD and the Internet. Lab fee required.

210. **Geometric Modeling for Mechanical Design** - Students will utilize computer-aided engineering to understand concepts in geometric modeling and engineering graphics with applications to mechanical design. Topics will include fundamentals of design; modeling visualization and preparation of engineering drawings, including multiview 3-D representations: orthographic projection and isometric perspective; solid modeling; dimensioning and tolerancing; modern prototyping and manufacturing techniques. Prerequisite: EGR 111 or 112.

215. **Principles of Electrical Engineering** - Basic AC, DC, and digital circuits and their applications in instrumentation. Lecture and laboratory grades are computed into one grade, and the same grade is recorded for both lecture and lab. Prerequisite: MTH 233. Co-requisite: EGR 215L. (Same as PHY 262).

215L. **Principles of Electrical Engineering Laboratory** - One semester hour, three hours lab per week. Lecture and laboratory grades are computed into one grade, and the same grade is recorded for both lecture and laboratory. Co-requisite: EGR 215. Lab fee required. (Same as PHY 262L.)

250. **Engineering Statics** - Four semester hours, three hours lecture, three hours lab per week. Prerequisites: MTH 234 and PHY 241 or permission of instructor. (Same as PHY 250.) Lab fee required.

305. **Mechanics of Materials** - Topics include stress and strain, uniaxially loaded members, centroids and area moments of inertia, normal and shear stresses, beam deflections, buckling of columns, pressure vessels, combined stresses and failure criteria. Prerequisite: EGR 250 or PHY 250.

321. **Engineering Dynamics** - Four semester hours, three hours lecture, three hours lab per week. Prerequisite: PHY 241 and MTH 234. (Same as PHY 321). Lab fee required.

343. **Electronics** - Three semester hours, two hours lecture, three hours lab per week. Design and integration of basic circuits into electronic instrumentation. Prerequisite: EGR 215 or PHY 262 or permission of instructor. Lab fee required. (Same as PHY 343.)

344. **Microcomputer Interfacing –** Three semester hours, two hours of lecture and three hours of lab per week. Microprocessor architecture, programming and interfacing. Introduction to assembly language programming, microcomputers, microcontrollers, instruction set, chip interfacing, addressing modes, interrupts, input/output and communication. Prerequisites: CSC 102 and EGR 343 or PHY 343.

345. **Fluid Mechanics** - The course covers basic concepts of a fluid and the fundamentals and applications of ideal and real fluid flow. Topics

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include fluid statistics, conversation principles, the Bernoulli equation, fluid flow in pipes, open channel flow and fluid flow measurement devices. Prerequisite: EGR 321 or PHY 321.

370. **Linear Circuit Analysis** - Transient circuit analysis, circuit analysis and design using the Laplace transform; convolution in time domain and frequency domain; transfer functions; frequency response and Bode plots; passive and active filter design; Fourier Transform; two-port circuits and balanced three-phase AC circuits. Prerequisite: EGR 215 or PHY 262, MTH 337 or permission of instructor.

414. **Control Systems** - Introduction to automatic control systems; mathematical models of physical systems; block diagrams and signal flow graphs; transient and steady state responses; PID controllers; stability of linear feedback systems; root-locus and Routh's criteria; frequency response methods; polar, Nyquist and Bode plots; stability margins; state-variable formulation. Prerequisite: EGR 370.

460. **Engineering Capstone Design** - Two semester hours. A capstone design project is taken up to the point of prototype construction, testing and hardware specification. The specific skills and knowledge needed by practicing engineers in the product realization process are emphasized and developed. Prerequisite: instructor permission.

470. **Undergraduate Research and Technical Presentation** - Two semester hours. The capstone project initiated in EGR 460 is taken from a prototype to a finished project. The project then undergoes laboratory testing and evaluation. Students present their results on a research poster and in oral presentations. Prerequisite: EGR 460.

475. **Special Problems** - One to four semester hours. Experimental or theoretical independent study in research. Not available for graduate credit. Prerequisites: 12 semester hours of engineering or physics.

476. **Special Problems** - One to four semester hours. A continuation of EGR 475. Experimental or theoretical independent study in research. Not available for graduate credit. Prerequisites: 12 semester hours of engineering or physics.

COURSES IN ASTRONOMY (AST)

*105. **Classical and Modern Astronomy*** - Introductory study of planetary astronomy, astrophysics and cosmology. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: AST 105L.

105L. **Classical and Modern Astronomy Laboratory** - One semester hour, two hours lab per week, including night viewing sessions by arrangement. Lecture and laboratory grades are computed into one grade and the same grade is recorded for both lecture and lab. Co-requisite: AST 105. Lab fee required.

305. **Observational Astronomy** - Three semester hours, two hours lecture and three hours lab per week. Fundamentals of practical sky observing include visual, photographic and photometric techniques using the research telescopes at the SFA Observatory. Prerequisite: MTH 139 or 140. Lab fee required.

335. **Astrophysics** - Properties of light, stellar evolution and galactic dynamics are treated in a quantitative manner. Prerequisites: AST 105, PHY 132 or 242, and MTH 234 or permission of instructor.

*Frequently has section offered as an internet course.

PRE-HEALTH PROFESSIONS PROGRAMS

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OVERVIEW
Within the pre-health professions programs at SFA, undergraduate students will be mentored and guided toward successful fulfillment of prerequisites for the professional program of their choosing. Their SFA education will be the foundation upon which professional training will be built.

Classification as a pre-health professional is a declaration of intent to pursue professional training following undergraduate studies. As an undergraduate, pre-health professions students will work toward a Bachelor of Science. (Some students choose a Bachelor of Arts path.) The student chooses the discipline upon which to focus, the major. None of the professional schools in Texas specify a required major. However, due to the number of science prerequisites, as well as the topics covered on many admissions examinations, majors and/or minors in disciplines such as biology and chemistry are common among professional school applicants.

Pre-professional programs at SFA covered by the pre-health professions advisor include pre-medicine, pre-occupational therapy, pre-optometry, pre-pharmacy, pre-physical therapy, pre-physician assistant and pre-veterinary medicine. (Animal science majors also may be advised within the Department of Agriculture).

Pre-professional programs at SFA that are advised outside of the pre-health professions include pre-nursing (School of Nursing), pre-law (Department of Government), and pre-engineering and pre-architecture (Department of Physics).

SFA PRE-HEALTH PROFESSIONAL PROGRAMS
The following specific descriptions are current as of the publication of this bulletin. Since each individual school defines prerequisites, they can and do vary from year to year and school to school. Completing the recommended coursework will allow the student to apply to all of the programs in the state. When given a choice of freshman- and sophomore-level courses in the sciences, the schools generally require those offered for the science majors. Some course substitutions may be permitted for those not majoring in the sciences. Current information on each of the following is available in the pre-health professions

advisor's office located in Miller Science Building, Room 127E.

Joint Admissions Medical Program
SFA is one of more than 30 public universities in Texas administering JAMP. JAMP is a special program created to support and encourage highly qualified, economically disadvantaged students pursuing a medical education through continued appropriations from the Texas Legislature. Students who satisfy both academic and non-academic requirements are guaranteed admission to at least one participating medical school in Texas. Applications can be obtained in the pre-health professions office.

Pre-Dentistry
There are three dental schools in Texas, and they require a minimum of 90 semester hours, although more than 90 percent of applicants complete a bachelor's degree prior to admission. Minimum course prerequisites include 14 hours of biology, 19 hours of chemistry (inorganic, organic and biochemistry), eight hours of physics and six hours of English. The Dental Admission Test also is required and may be scheduled at any time through Sylvan Technology Centers.

Pre-Medicine
There are eight medical schools in Texas, and they require a composite minimum of 90 semester hours, although more than 95 percent of applicants complete a bachelor's degree prior to admission. Minimum course prerequisites include 14 hours of biology, 16 hours of chemistry (general and organic), eight hours of physics and six hours of English. The Medical College Admissions Test also is required.

Pre-Optometry
There is one Texas school offering a Doctor of Optometry degree, and it requires a baccalaureate for admission, with 20 semester hours of biology, 15 hours of chemistry (inorganic, organic and biochemistry), nine hours of mathematics, eight hours of physics and three hours of psychology. The Optometric Admissions Test also is required for admission.

Pre-Occupational Therapy
There are six schools that offer occupational therapy programs in Texas, all at the master's level. Composite course prerequisites include 19 semester hours of biology (including medical terminology); four hours of inorganic chemistry; four hours of physics; six hours of mathematics; nine hours of English; nine hours of psychology; six hours of sociology; and the remainder in history, political science and humanities, kinesiology and electives. Additionally, most schools require 20-40 hours of field observation time in support of the application, and one school requires the Health Occupations Aptitude Exam.

Pre-Pharmacy
There are six pharmacy schools in Texas, none of which require a bachelor's degree for admission. However, because of the competitiveness of the programs, a bachelor's degree is recommended. Composite course requirements include 20 semester hours of biology; 16 hours of chemistry (inorganic and organic); eight hours of physics; six hours of mathematics; 12 hours of English and speech; and the remainder in history, political science and behavioral, cultural or social sciences. The Pharmacy College Admissions Test also is required for admission.

UH-SFA Cooperative Pre-Pharmacy Program
Currently, SFA is one of the only two public universities in Texas administering a cooperative Pre-Pharmacy Program with the University of Houston College of

Pharmacy. The purpose of the UH/SFA cooperative Pre-Pharmacy Program is to facilitate access to the UHCP by providing opportunities to fulfill prerequisite courses at SFA. Students can be admitted into the UHCP either through this program or by applications directly to the UHCP after completion of the pre-pharmacy requirements. Applications can be obtained in the pre-health professions office.

Pre-Physical Therapy
There are nine physical therapy schools that offer the doctoral degree, all of which require a bachelor's degree for admission. Composite course prerequisites include 19 semester hours biology (including medical terminology); eight hours of inorganic chemistry; eight hours of physics; six hours of mathematics; 15 hours of English and speech; six hours of psychology; and the remainder in history, political science and behavioral, cultural or social sciences. Additionally, a minimum of 75-150 hours of field observation time in up to three different settings is required in support of the application.

Pre-Physician Assistant
There are seven schools in Texas, none of which require a bachelor's degree for admission. However, because of the competitiveness of the programs, a bachelor's degree is recommended. Composite course requirements include 20 semester hours of biology; 16 hours of chemistry (inorganic and organic); six hours of mathematics; 12 hours of English and speech; and the remainder in history, political science and behavioral, cultural or social sciences, medical terminology (recommended). The Graduate Record Exam also is required for admission.

Pre-Veterinary Medicine
There is only one veterinary school in Texas. It does not require a bachelor's degree for admission, but because of the competition, a bachelor's degree is highly recommended. Prerequisites include 12 semester hours of biology, 19 hours of chemistry (inorganic, organic and biochemistry), three hours of mathematics, eight hours of physics, 12 hours of English and speech, and four hours of animal nutrition. Experience in working with large animals is recommended.

Sciences and Mathematics