Department of Physics

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Christopher Littler, Chair

Faculty

Professors Deering, Duggan, Grigolini, Hu, Kobe, Krohkin, C. Littler, Matteson, McDaniel, Mueller, Ordonez, Perez, Quintanilla, Roberts. *Associate Professors* Kowalski, Neogi, Shiner, Weathers. *Assistant Professor* Rout. *Lecturers* Lawler, K. Littler.

Introduction

From advancing state-of-the-art processes in the semiconductor industry to developing computer software for simulating exotic phenomena, physicists and engineering physicists are helping to expand the frontiers of both basic science and high technology. The diversity of work conducted by physicists and engineering physicists occurs because physical science and engineering disciplines are based, to a large extent, on physics principles. A bachelor's degree in physics or engineering physics also prepares students for graduate work in acoustics, astrophysics, biophysics, computational physics, medical physics and other subfields and interdisciplinary fields in physics.

Programs of Study

The department offers the following undergraduate and graduate programs:

- Bachelor of Arts with a major in physics;
- Bachelor of Science in Physics;
- Bachelor of Science in Engineering Physics;
- Master of Arts,
- Master of Science, and
- Doctor of Philosophy, all with a major in physics.

Undergraduate Research

Undergraduate research opportunities are available for undergraduate students interested in physics and engineering physics. Students should consult the undergraduate advisor.

Bachelor of Arts

Major in Physics

The BA with a major in physics is designed for students planning to teach physics in public school, taking a double major or desiring a liberal arts education with a science concentration.

Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor of Arts degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements.
2. **Major Requirements:** 27 hours in physics to include: PHYS 1710/1730 (or 1410/1430 and 1420/1440 or 1510/1530), 2220/2240 (or 1520/1540), 3010/3030; plus 15 more hours of advanced level physics courses. PHYS 2900, 2910, 4900 and 4910 may not count toward a bachelor's degree in physics.
3. **Other Course Requirements:** MATH 1710, 1720 and 2730; and CHEM 1410/1430 and 1420/1440.
4. **Minor:** Optional.
5. **Electives:** See four-year plan.
6. **Other Requirements:** Substitutions in the BA or BS degree programs may be made only with the written consent of the department chair. A minimum grade point average of 2.5 in all advanced-level science and mathematics courses is required for graduation with a degree in physics or engineering physics.

BA with a Major in Physics

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
CHEM 1410/1430, General Chemistry I and Laboratory**	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I	4
Social and Behavioral Sciences*	3
Total	14

SPRING	HOURS
CHEM 1420/1440, General Chemistry II and Laboratory**	4
ENGL 1320, College Writing II, or ENGL 1323, Computer Assisted College Writing II (ENGL 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PHYS 1710/1730, Mechanics and Laboratory	4
Total	14

SOPHOMORE YEAR

FALL	HOURS
LANG 2040, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
MATH 2730, Multivariable Calculus	3
PHYS 2220/2240, Electricity and Magnetism and Laboratory	4
PSCI 1040, American Government*	3
Humanities*	3
Total	16

SPRING	HOURS
LANG 2050, Foreign Language (intermediate, may be used to satisfy a portion of the Understanding the Human Community requirement)**	3
PHYS 3010/3030, Modern Physics and Laboratory	4
PSCI 1050, American Government*	3
Elective	3
Visual and Performing Arts*	3
Total	16

JUNIOR YEAR

FALL	HOURS
HIST 2610, United States History to 1865*	3
PHYS Elective (advanced)	3
Elective (advanced)	3
Elective (advanced)	3
Elective	3
Total	15

SPRING	HOURS
HIST 2620, United States History Since 1865*	3
PHYS Elective (advanced)	3
PHYS Elective (advanced)	3
Elective (advanced)	3
Elective	3
Total	15

SENIOR YEAR

FALL	HOURS
PHYS Elective (advanced)	3
Elective (advanced)	3
Elective (advanced)	2
Elective	4
Natural Sciences**	3
Total	15

SPRING	HOURS
PHYS Elective (advanced)	3
Elective (advanced)	3
Elective (advanced)	3
Elective (advanced)	3
Elective	3
Total	15

****See the University Core Curriculum section of this catalog for approved list of course options.***
***** See Arts and Sciences degree requirements section of this catalog for approved list of course options.***

Actual degree audits may vary depending on availability of courses in a given semester.
Some courses may require prerequisites not listed.
Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Bachelor of Science in Physics

Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 120 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor of Science degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements (excluding foreign language and natural and life sciences).

2. **Major Requirements:**

Option I Required courses: Minimum of 49 hours in physics, including PHYS 1710/1730 (or 1410/1430 and 1420/1440 or 1510/1530 and 1520/1540), 2220/2240, 3010/3030, 3210, 3310, 3420, 4110, 4210, 4310 and 4950 (6 hours), plus 9 additional hours of advanced-level physics courses and 3 hours chosen from PHYS 1052, 1062 and 1270. PHYS 2900, 2910, 4900 and 4910 may not count toward a bachelor's degree in physics.

Option II Required Courses: Minimum of 36 hours in physics, including PHYS 1710/1730 (or 1410/1430 and 1420/1440 or 1510/1530 and 1520/1540), 2220/2240, 3010/3030, 3210, 3310, 4110, 4210, 4310 and 4950 (6 hours), plus 3 additional hours of advanced-level physics courses. PHYS 2900, 2910, 4900 and 4910 may not count toward a bachelor's degree in physics.

3. **Other Course Requirements:** MATH 1710, 1720, 2700, 2730 and 3410; CHEM 1410/1430 and 1420/1440; and CSCE 1020.

4. **Minor:** A minor in general engineering technology is required for Option II.

5. **Electives:** See four-year plan.

6. **Other requirements:** Substitutions in the BA or BS degree programs may be made only with the written consent of the department chair. A minimum grade point average of 2.5 in all advanced-level science and mathematics courses is required for graduation with a degree in physics or engineering physics.

BS in Physics (Option 1)

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
CHEM 1410/1430, General Chemistry I and Laboratory*	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I	4
PHYS 1052, The Solar System, or PHYS 1062, Stars and the Universe, or PHYS 1270, Science and Technology of Musical Sound	3
Total	14

SPRING	HOURS
CHEM 1420/1440, General Chemistry II and Laboratory*	4
ENGL 1320, College Writing II, or ENGL 1323, Computer Assisted College Writing II (ENGL 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PHYS 1710/1730, Mechanics and Laboratory	4
Total	14

SOPHOMORE YEAR

FALL	HOURS
MATH 2730, Multivariable Calculus	3
PHYS 2220/2240, Electricity and Magnetism and Laboratory	4
Humanities*	3
Understanding the Human Community*	3
Total	13

SPRING	HOURS
MATH 2700, Linear Algebra and Vector Geometry	3
PHYS 3010/3030, Modern Physics and Laboratory	4
Social and Behavioral Sciences*	3
Understanding the Human Community*	3
Visual and Performing Arts*	3
Total	16

JUNIOR YEAR

FALL	HOURS
HIST 2610, United States History to 1865*	3
MATH 3410, Differential Equations I	3
PHYS 3210, Mechanics	3
PHYS 3310, Mathematical Methods in the Physical Sciences	3
PHYS 3420, Electronics	4
Total	16

SPRING	HOURS
CSCE 1020, Program Development	4
HIST 2620, United States History Since 1865*	3
PHYS 4310, Quantum Mechanics	3
PHYS Elective (advanced)	3
Elective	3
Total	16

SENIOR YEAR

FALL	HOURS
PHYS 4210, Electricity and Magnetism	3
PSCI 1040, American Government*	3
PHYS Elective (advanced)	3
PHYS Elective (advanced)	3
Elective	3

Elective (advanced)	1
Total	16

SPRING	**HOURS**
PHYS 4110, Statistical and Thermal Physics	3
PHYS 4950, Senior Thesis	6
PSCI 1050, American Government*	3
Elective	3
Total	15

See the University Core Curriculum section of this catalog for approved list of course options.
****See Arts and Sciences degree requirements section of this catalog for approved list of course options.***

Actual degree audits may vary depending on availability of courses in a given semester.
Some courses may require prerequisites not listed.
Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

BS in Physics (Option 2)

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	**HOURS**
CHEM 1410/1430, General Chemistry I and Laboratory**	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I**	4
Understanding the Human Community*	3
Total	14

SPRING	**HOURS**
CHEM 1420/1440, General Chemistry II and Laboratory**	4
ENGL 1320, College Writing II, or ENGL 1323, Computer Assisted College Writing II (ENGL 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PHYS 1710/1730, Mechanics and Laboratory	4
Total	14

SOPHOMORE YEAR

FALL	**HOURS**
MATH 2730, Multivariable Calculus	3
PHYS 2220/2240, Electricity and Magnetism and Laboratory	4
Humanities*	3
General Engineering Technology Minor	3
Understanding the Human Community*	3
Total	16

SPRING	**HOURS**
MATH 2700, Linear Algebra and Vector Geometry	3
PHYS 3010/3030, Modern Physics and Laboratory	4
Social and Behavioral Sciences*	3
Visual and Performing Arts*	3
Total	13

JUNIOR YEAR

FALL	**HOURS**
HIST 2610, United States History to 1865*	3
MATH 3410, Differential Equations I	3
PHYS 3210, Mechanics	3
PHYS 3310, Mathematical Methods in the Physical Sciences	3
Elective (advanced)	4
Total	16

SPRING	**HOURS**
CSCE 1020, Program Development	4
HIST 2620, United States History Since 1865*	3
PHYS 4310, Quantum Mechanics	3
PHYS Elective (advanced)	3
General Engineering Technology Minor	3
Total	16

SENIOR YEAR

FALL	**HOURS**
PHYS 4210, Electricity and Magnetism	3
PSCI 1040, American Government*	3
General Engineering Technology Minor (advanced)	3
General Engineering Technology Minor (advanced)	3
General Engineering Technology	3
Elective (advanced)	1
Total	16

SPRING	**HOURS**
PHYS 4110, Statistical and Thermal Physics	3
PHYS 4950, Senior Thesis	6
PSCI 1050, American Government*	3
General Engineering Technology Minor	3
Total	15

See the University Core Curriculum section of this catalog for approved list of course options.
****See Arts and Sciences degree requirements section of this catalog for approved list of course options.***

Actual degree audits may vary depending on availability of courses in a given semester.
Some courses may require prerequisites not listed.
Students may wish to use opportunities for electives to complete a minor of their choice or secondary education courses for teacher certification.

Bachelor of Science in Engineering Physics

Degree Requirements

1. **Hours Required and General/College Requirements:** A minimum of 121 semester hours, of which 42 must be advanced, and fulfillment of degree requirements for the Bachelor of Science degree as specified in the "General University Requirements" in the Academics section of this catalog and the College of Arts and Sciences requirements (excluding foreign language and natural and life sciences).

2. **Major Requirements:** At least 30 semester hours in physics to include: PHYS 1710/1730, 2220/2240, 3010/3030, 3210, 3310, 4110, 4210 and 4310; plus 3 hours of advanced-level physics courses and at least 30 hours of engineering technology to include: ENGR 2301, 2302, 2332, 2405; plus 16 hours chosen from ENGR 2720 and 2750, ELET 3970, MEET 3650, 3660, 3940 and 4350, and MFET 2100, 3250 and 3450. PHYS 2900, 2910, 4900 and 4910 may not count toward a bachelor's degree in engineering physics.

3. **Other Course Requirements:** MATH 1710, 1720, 2700, 2730 and 3410; CHEM 1410/1430 or 1413/1430, and 1420/1440 or 1423/1440; and CSCE 1020.

4. **Minor:** Optional.

5. **Electives:** See four-year plan.

6. **Other Requirements:** Substitutions in the BA or BS degree programs may be made only with the written consent of the department chair. A minimum grade point average of 2.5 in all advanced-level science, mathematics and engineering courses is required for graduation with a degree in physics or engineering physics.

BS in Engineering Physics

The following four-year plan is one example of a variety of ways in which you can complete your chosen degree in four years, and will serve as guide for you to design your pathway to degree completion. Variations will depend on whether you need to take prerequisites or have college credit from exams or dual enrollment.

The College of Arts and Sciences expects you to have completed the State recommended high school program and be ready to enroll for Language 2040 or a mathematics course above college algebra. If you are not prepared for this level, the necessary prerequisites will either replace electives or increase the hours required for the degree.

FRESHMAN YEAR

FALL	HOURS
CHEM 1410/1430, General Chemistry I and Laboratory*	4
ENGL 1310, College Writing I, or ENGL 1313, Computer Assisted College Writing I*	3
MATH 1710, Calculus I**	4
Social and Behavioral Sciences*	3
Total	14

SPRING	HOURS
CHEM 1420/1440, General Chemistry II and Laboratory**	4
ENGL 1320, College Writing II, or ENGL 1323, Computer Assisted College Writing II (ENGL 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PHYS 1710/1730, Mechanics and Laboratory	4
Total	14

SOPHOMORE YEAR

FALL	HOURS
ENGR 2301, Statics	3
MATH 2730, Multivariable Calculus	3
PHYS 2220/2240, Electricity and Magnetism and Laboratory	4
Humanities*	3
Visual and Performing Arts*	3
Total	16

SPRING	HOURS
CSCE 1020, Program Development	4
ENGR 2302, Dynamics	3
MATH 2700, Linear Algebra and Vector Geometry	3
PHYS 3010/3030, Modern Physics and Laboratory	4
Understanding the Human Community* (advanced recommended)	3
Total	17

JUNIOR YEAR

FALL	HOURS
ENGR 2405, Fundamentals of Electrical Engineering	4
HIST 2610, United States History to 1865*	3
MATH 3410, Differential Equations I	3
PHYS 3210, Mechanics	3
PHYS 3310, Mathematical Methods in Physical Sciences	3
Total	16

SPRING	HOURS
HIST 2620, United States History Since 1865*	3
PHYS 4110, Statistical and Thermal Physics	3
Engineering Selection (advanced)	3
Engineering Selection (advanced)	3
Understanding the Human Community* (advanced recommended)	3
Total	15

SENIOR YEAR

FALL	HOURS
ENGR 2332, Mechanics of Materials	4
PHYS 4210, Electricity and Magnetism	3
PSCI 1040, American Government*	3
Engineering Selection (advanced)	3
Engineering Selection (advanced)	3
Total	16

SPRING	HOURS
PHYS 4310, Quantum Mechanics	3
PSCI 1050, American Government*	3
PHYS Elective (advanced)	3
Engineering Selection (advanced)	4
Total	13

See the University Core Curriculum section of this catalog for approved list of course options.
***** See Arts and Sciences degree requirements section of this catalog for approved list of course options.***

Actual degree audits may vary depending on availability of courses in a given semester.
Some courses may require prerequisites not listed.
Students may wish to use opportunities for electives to complete a minor of their choice.

Mathematics Requirements

Students who must schedule physics courses with mathematics prerequisites must plan their mathematics programs carefully. Freshmen should note mathematics placement procedures described in the Department of Mathematics section of this catalog. Physics majors who are advised to take MATH 1650 prior to MATH 1710 may count this course as elective credit.

Minor in Physics

A minor in physics consists of a minimum of 18 hours of physics courses, including 10 advanced hours. PHYS 2900, 2910, 4900 and 4910 may not count toward a minor in physics.

Teacher Certification

The College of Arts and Sciences encourages students to explore teaching at the secondary level as a career option. The student's academic advisor in the Dean's Office for Undergraduates and Student Advising in GAB, Room 220, can assist students with specific requirements for teacher certification.

Requirements utilizing the BA degree in Physics with Certification in Physics/Mathematics: PHYS 1710/1730, 2220/2240, 3010/3030, 4700, 12 hours of any upper-division PHYS courses (except 4900, 4910); MATH 1710, 1720, 2510, 2730, 4060. Upon completion of this program, students will be prepared to sit for the certification examinations in Physics/Mathematics.

Requirements utilizing the BA degree in Physics with Certification in Physical Science: PHYS 1710/1730, 2220/2240, 3010/3030, 4700, 12 hours any upper-division PHYS courses (except 4900, 4910); CHEM 1410/1430 or 1412/1430 or 1413/1430; CHEM 1420/1440 or 1422/1440 or 1423/1440. Upon completion of this program, students will be prepared to sit for the certification examinations in Physical Science.

See major for additional course work and GPA requirements.

Students must also complete the required 21 hours in upper-level education courses (EDSE 3800, 3830, 4060, 4070, 4108, 4118, 4840) and meet all GPA requirements to apply for state certification. In order to enroll for the first required education course, the student must make application to the certification program in the College of Education in Matthews Hall, Room 105.

All state certification requirements and information on required examinations is available on the web site of the State Board for Educator Certification (SBEC), *www.sbec.state.tx.us*.

Graduate Degrees

The department offers degree programs leading to the Master of Arts, Master of Science and Doctor of Philosophy. For information, consult the *Graduate Catalog.*

Courses of Instruction

All Courses of Instruction are located in one section at the back of this catalog.