Department of Physics

Main Departmental Office
Physics Building, Room 110

Mailing address:
1155 Union Circle #311427
Denton, TX 76203-5017
940-565-2626
Fax: 940-565-2515

E-mail: physics@unt.edu
Web site: *www.phys.unt.edu*

Christopher Littler, Chair

Faculty

Duggan, Grigolini, Hu, Kobe, Kowalski, Krohkin, Lawler, C. Littler, K. Littler, Matteson, McDaniel, Mueller, Neogi, Ordonez, Perez, Philipose, Quintanilla, Reinert, Roberts, Rostovtsev, Rout, Shemmer, Shiner, Weathers

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 advanced 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/PHYS 1730 (or PHYS 1410/PHYS 1430 and PHYS 1420/PHYS 1440 or PHYS 1510/PHYS 1530), PHYS 2220/PHYS 2240 (or PHYS 1520/PHYS 1540), PHYS 3010/PHYS 3030; plus 15 more hours of advanced level physics courses. PHYS 2900, PHYS 2910, PHYS 4900 and PHYS 4910 may not count toward a bachelor's degree in physics.

3. **Other Course Requirements:** MATH 1710, MATH 1720 and MATH 2730; and CHEM 1410/CHEM 1430 and CHEM 1420/CHEM 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/CHEM 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/CHEM 1440, General Chemistry II and Laboratory**	4
ENGL 1320, College Writing II, or ENGL 1323, Computer Assisted College Writing II (TECM 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PHYS 1710/PHYS 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/PHYS 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/PHYS 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 46 hours in physics, including PHYS 1710/PHYS 1730 (or PHYS 1410/PHYS 1430 and PHYS 1420/PHYS 1440 or PHYS 1510/PHYS 1530 and PHYS 1520/PHYS 1540), PHYS 2220/PHYS 2240, PHYS 3010/PHYS 3030, PHYS 3210, PHYS 3310, PHYS 3420, PHYS 4110, PHYS 4210, PHYS 4310 and PHYS 4950 (6 hours), plus 9 additional hours of advanced-level physics courses. PHYS 2900, PHYS 2910, PHYS 4900 and PHYS 4910 may not count toward a bachelor's degree in physics.

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

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

4. **Minor:** Option II requires a minor in mathematics and science secondary teaching or a minor in general engineering technology. Students seeking secondary teacher certification should see requirements listed under "Teacher Certification."

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

SOPHOMORE YEAR

FALL	HOURS
MATH 2730, Multivariable Calculus	3
PHYS 2220/PHYS 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/PHYS 3030, Modern Physics and Laboratory	4
Elective	3
Social and Behavioral Sciences*	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
Elective	3
Total	15

SPRING	HOURS
CSCE 1020, Program Development	4
HIST 2620, United States History Since 1865*	3
PHYS 4110, Statistical and Thermal Physics	3
PHYS 3420, Electronics	4
PHYS Elective (advanced)	3
Total	17

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 4310, Quantum Mechanics	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.

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

3. **Other Course Requirements:** MATH 1710, MATH 1720, MATH 2700, MATH 2730 and MATH 3410; CHEM 1410/CHEM 1430 or CHEM 1413/CHEM 1430, and CHEM 1420/CHEM 1440 or CHEM 1423/CHEM 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/CHEM 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/CHEM 1440, General Chemistry II and Laboratory**	4
ENGL 1320, College Writing II, or ENGL 1323, Computer Assisted College Writing II (TECM 2700, Technical Writing recommended)*	3
MATH 1720, Calculus II	3
PHYS 1710/PHYS 1730, Mechanics and Laboratory	4
Total	14

SOPHOMORE YEAR

FALL	HOURS
ENGR 2301, Statics	3
MATH 2730, Multivariable Calculus	3
PHYS 2220/PHYS 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/PHYS 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.

Minors

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.

Mathematics and Science Secondary Teaching

Individuals interested in pursuing certification in math or science teaching at the secondary level may wish to pursue a minor through the Teach North Texas program. See "Teach North Texas" in the College of Arts and Sciences section of this catalog.

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/PHYS 1730, PHYS 2220/PHYS 2240, PHYS 3010/PHYS 3030, PHYS 4700, 12 hours of any upper-division PHYS courses (except PHYS 4900, PHYS 4910); MATH 1710, MATH 1720, MATH 2730, MATH 3000, MATH 4060; CHEM 1410/CHEM 1430 or CHEM 1412/CHEM 1430 or CHEM 1413/CHEM 1430; CHEM 1420/CHEM 1440 or CHEM 1422/CHEM 1440 or CHEM 1423/CHEM 1440. 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/PHYS 1730, PHYS 2220/PHYS 2240, PHYS 3010/PHYS 3030, PHYS 4700, 12 hours any upper-division PHYS courses (except PHYS 4900, PHYS 4910); CHEM 1410/CHEM 1430 or CHEM 1412/CHEM 1430 or CHEM 1413/CHEM 1430; CHEM 1420/CHEM 1440 or CHEM 1422/CHEM 1440 or CHEM 1423/CHEM 1440; MATH 1710, MATH 1720, MATH 2730. Upon completion of this program, students will be prepared to sit for the certification examinations in Physical Science.

Requirements utilizing the BS Physics degree Option II with Certification in Physics/Mathematics: PHYS 1710/PHYS 1730, PHYS 2220/PHYS 2240, PHYS 3010/PHYS 3030, PHYS 3210, PHYS 3310, PHYS 4110, PHYS 4210, PHYS 4310, PHYS 4700, PHYS 4950 (6 hours); CHEM 1420/CHEM 1440 or CHEM 1422/CHEM 1440 or CHEM 1423/CHEM 1440; CSCE 1020; MATH 1710, MATH 1720, MATH 2700, MATH 2730, MATH 3410, MATH 4060. Upon completion of this program, students will be prepared to sit for the certification examinations in Physics/Mathematics.

Requirements utilizing the BS Physics degree Option II with Certification in Physical Science: PHYS 1710/PHYS 1730, PHYS 2220/PHYS 2240, PHYS 3010/PHYS 3030, PHYS 3210, PHYS 3310, PHYS 4110, PHYS 4210, PHYS 4310, PHYS 4700, PHYS 4950 (6 hours); CHEM 1410/CHEM 1430 or CHEM 1412/CHEM 1430 or CHEM 1413/CHEM 1430; CHEM 1420/CHEM 1440 or CHEM 1422/CHEM 1440 or CHEM 1423/CHEM 1440; CSCE 1020; MATH 1710, MATH 1720, MATH 2700, MATH 2730, MATH 3410. 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 "Perspectives on Science and Mathematics" (this requirement may be fulfilled by UCRS 4000 or any other course approved by the co-directors of Teach North Texas), 18 hours in education courses (TNTX 1100 and TNTX 1200, EDSE 3500, EDSE 4000, EDSE 4500, EDSE 4608, EDSE 4618, EDSE 4128), 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.

Course and Subject Guide

The "Course and Subject Guide," found in the Courses of Instruction section of this book, serves as a table of contents and provides quick access to subject areas and prefixes.

Department of Political Science

Main Departmental Office
Wooten Hall, Room 125

Mailing address:
1155 Union Circle, #305340
Denton, TX 76203-5017
940-565-2276

Web site: *www.psci.unt.edu*

Political Science Advising Office
Wooten Hall, Room 141
940-565-2310

John Todd, Chair

Faculty

Blackstone, Books, Booth, Breuning, Carey, Collins, Cox, De Meritt, Enterline, Eshbaugh-Soha, Forde, Gibbons, Greig, Hendrix, Hensel, Ishiyama, King, Maeda, Martinez-Ebers, Mason, Matsubayashi, Meaders, Meernik, Oldmixon, Paolino, Ruderman, Sahliyeh, Salehyan, Solowiej, Todd

Introduction

Department courses meet the needs of both undergraduate and graduate students preparing to enter national, state and local government employment; public and private foreign service; law; politics; public and private research; writing and reporting of public affairs and political science; and government and social science teaching.

Pre-Law Information

UNT annually prepares many students to enter law schools. No prescribed program of courses has been found to be key for a successful law career. A grade point average of 3.5 or higher will be competitive for admission to a nationally recognized school, but a minimum of 3.0 is suggested to apply for admission to law school. While many students undertake a liberal arts degree, law schools place important emphasis on the diversity of their student body and seek persons from different backgrounds, including the natural sciences. Consequently, there is no pre-law program of courses; however, UNT offers an array of courses that will help prepare you.

Future law school students should take courses that emphasize writing and oral skills, research into problems facing society, logical reasoning, the American legal system and Constitutional Law. Pre-law students should take the Law School Admission