

PHYSICS, BS

Program Description

Introduction

The Joint BS Physics degree is a Bachelor of Science degree with a Physics major, provided through the joint efforts of physics faculty both here at TAMUCC and at other schools in the Texas Physics Consortium (TPC) (<https://www.tarleton.edu/tpc/>). Interested students are encouraged to visit the TPC website at <http://www.tarleton.edu/tpc/>. Upper-level physics courses can originate at any of the TPC schools, and students at any of the other TPC schools can take them via distance education.

Physics courses are also offered in support of other major study areas in the sciences, mathematics, computer science, engineering and technology, and 7-12 level physical science teaching certification.

Student Learning Outcomes

Students obtaining the Joint BS in Physics will:

- possess a broad understanding of physics.
- understand scientific methods and be able use them to develop and conduct studies of physical systems.
- communicate physical information effectively at the undergraduate level, whether the communication is in oral or written form, with or without the use of technology.

General Requirements

| Requirements | Credit Hours |
|---|----------------|
| First-Year Seminars (when applicable) ¹ | 0-2 |
| Core Curriculum Program (http://catalog.tamucc.edu/undergraduate/university-college/programs/core-curriculum-program/) | 42 |
| Required non-TPC Courses | 12 |
| Required TPC Courses | 32 |
| Electives | 34 |
| Total Credit Hours | 120-122 |

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Full-time, first time in college students are required to take the first-year seminars.

- UNIV 1101 University Seminar I (1 sch)
- UNIV 1102 University Seminar II (1 sch)

Students must complete 45 semester hours of upper division courses (3000 level or above).

At least one semester before a student's intended graduation date, physics students must meet with the physics program coordinator or designated faculty or staff member to fill out the Texas Physics Consortium Graduation Checkout Form. This will be provided to the TPC Administrative Council, who meets shortly before every Spring and Fall semester to review and approve graduates for that semester.

Program Requirements

| Code | Title | Hours |
|--|---|-------|
| Full-time, First-year Students | | |
| UNIV 1101 | University Seminar I | 1 |
| UNIV 1102 | University Seminar II | 1 |
| Core Curriculum Program | | |
| University Core Curriculum | | 42 |
| Students majoring in Physics must take: | | |
| MATH 2413 | Calculus I | |
| MATH 2414 | Calculus II | |
| PHYS 2425 | University Physics I | |
| PHYS 2426 | University Physics II | |
| Required Non-TPC Courses ¹ | | |
| MATH 2413 | Calculus I (included in University Core) ² | |
| MATH 2414 | Calculus II (included in University Core) ² | |
| PHYS 2425 | University Physics I (included in University Core) ² | |
| PHYS 2426 | University Physics II (included in University Core, 1 hour laboratory component) ² | 1 |
| MATH 2415 | Calculus III | 4 |
| MATH 3315 | Differential Equations | 3 |
| COSC 1435 | Introduction to Problem Solving with Computers I | 4 |
| PHYS 4085 | Major Field Test in Physics | 0 |
| Required TPC Courses ³ | | |
| PHYS 3331 | Mechanics I | 3 |
| PHYS 3334 | Modern Physics I | 3 |
| PHYS 3332 | Electromagnetism | 3 |
| PHYS 3333 | Thermodynamics | 3 |
| PHYS 4330 | Mathematical Methods for Physicists | 3 |
| PHYS 4335 | Quantum Physics | 3 |
| PHYS 4337 | Nuclear Physics | 3 |
| PHYS 4340 | Advanced Physics Lab | 3 |
| PHYS 4161 | Physics Research Project | 1 |
| PHYS 4162 | Physics Research Seminar | 1 |
| PHYS 3490 | Selected Topics (repeat to total 6 hours) ⁴ | 6 |
| Electives | | |
| Students must choose their electives to make sure that they have 45 semester hours of upper-division courses (3000-level and above), as required by the College of Science | | |
| Support Field Electives | | |
| Select 18 hours in consultation with physics faculty advisor. Courses 18 that could be used could include (but are not limited to) the following: ⁵ | | |
| PHYS 3490 | Selected Topics (if taken beyond the required 6 hours) | |
| MATH 3311 | Linear Algebra | |
| COSC 1436 | Introduction to Problem Solving with Computers II | |
| ENGR 3315 | Fluid Mechanics | |
| ESCI 3351 | Oceanography | |
| ESCI 4335 | Climate and Climate Variability | |
| ESCI 4360 | Physical Oceanography | |
| GEOL 4422 | Geophysics | |
| MEEN 3345 | Heat Transfer | |

General Electives

| | |
|---|------------|
| Select 16 hours of General Electives not categorized above ⁶ | 16 |
| Total Hours | 122 |

1

These TAMUCC courses are required as part of the Joint BS in Physics degree. They are local courses, not TPC courses. These courses may not be taken on a pass/no pass (P/NP) basis.

2

15 credits hours for these courses are included in the University Core Curriculum tally above, and are not included in the total in this section. They fulfill the 3 hours of mathematics, 6 hours of life and physical sciences, and the 6 hour Component Area Option. One remaining credit does count in this section. Any other Core Curriculum Program courses taken in those categories will count as electives.

3

These courses are offered from one of the members of the Texas Physics Consortium (<https://www.tarleton.edu/tpc/>) (possibly from TAMUCC). Any substitutions for these courses, including transfer credits, must be approved by the Administrative Council of the Texas Physics Consortium.

4

The Selected Topics course is used for the TPC Advanced Physics Elective courses, which change from year to year. Any cataloged Advanced Physics courses can also fill this role.

5

The Support Field enables students the flexibility to tailor their degree to meet various academic and career goals, including teaching certification and interdisciplinary studies. The courses must be chosen in consultation with their physics faculty advisor. For students transferring into the Physics Major, these courses may be selected from those already taken from the student's former major.

6

The first-year seminar courses listed above count as general electives.

This sequence is a suggestion. It's certainly not the only way to fulfill the requirements.

Course Sequencing

First Year

| Fall | | Hours |
|--------------|--|-----------|
| UNIV 1101 | University Seminar I | 1 |
| COSC 1435 | Introduction to Problem Solving with Computers I | 4 |
| MATH 2413 | Calculus I | 4 |
| ENGL 1301 | Writing and Rhetoric I | 3 |
| HIST 1301 | U.S. History to 1865 | 3 |
| Hours | | 15 |
| Spring | | Hours |
| UNIV 1102 | University Seminar II | 1 |
| MATH 2414 | Calculus II | 4 |
| ENGL 1302 | Writing and Rhetoric II | 3 |
| | or COMM 1311 or Foundation of Communication | |
| HIST 1302 | U.S. History Since 1865 | 3 |
| PHYS 2425 | University Physics I | 4 |
| Hours | | 15 |

Second Year

Fall

| | | |
|---|------------------------------|-----------|
| PHYS 2426 | University Physics II | 4 |
| MATH 2415 | Calculus III | 4 |
| Language, Philosophy & Culture Core Requirement | | 3 |
| Creative Arts Core Requirement | | 3 |
| POLS 2305 | U.S. Government and Politics | 3 |
| Hours | | 17 |

Spring

| | | |
|---|---|-----------|
| PHYS 3334 | Modern Physics I | 3 |
| MATH 3315 | Differential Equations | 3 |
| COSC 1436 | Introduction to Problem Solving with Computers II | 4 |
| Social and Behavioral Sciences Core Requirement | | 3 |
| POLS 2306 | State and Local Government | 3 |
| Hours | | 16 |

Third Year

Fall

| | | |
|--------------|------------------|-----------|
| PHYS 3331 | Mechanics I | 3 |
| PHYS 3332 | Electromagnetism | 3 |
| PHYS 3490 | Selected Topics | 3 |
| MATH 3311 | Linear Algebra | 3 |
| Elective | | 3 |
| Hours | | 15 |

Spring

| | | |
|---------------|-------------------------------------|-----------|
| PHYS 4330 | Mathematical Methods for Physicists | 3 |
| PHYS 4340 | Advanced Physics Lab | 3 |
| PHYS 3490 | Selected Topics | 3 |
| Support Field | | 3 |
| Elective | | 3 |
| Hours | | 15 |

Fourth Year

Fall

| | | |
|---------------------|--------------------------|-----------|
| PHYS 4335 | Quantum Physics | 3 |
| PHYS 4161 | Physics Research Project | 1 |
| PHYS 3333 | Thermodynamics | 3 |
| Support Field | | 3 |
| Elective | | 3 |
| UL Support Elective | | 3 |
| Hours | | 16 |

Spring

| | | |
|--------------------|---|------------|
| PHYS 4337 | Nuclear Physics | 3 |
| PHYS 4162 | Physics Research Seminar | 1 |
| UL Support Field | | 3 |
| UL Support Field | | 3 |
| Elective | | 3 |
| PHYS 4085 | Major Field Test in Physics (Must be taken in last semester.) | 0 |
| Hours | | 13 |
| Total Hours | | 122 |

Courses

PHYS 1303 Introduction to Astronomy: Stars and Galaxies

3 Semester Credit Hours (2 Lecture Hours, 2 Lab Hours)

This is one of two courses in the introduction to astronomy sequence which emphasizes the nature of astronomical phenomena over the mathematical analysis of them. This course will focus mostly on the nature of light, the nature and evolution of stars, the material between the stars, the Milky Way Galaxy, external galaxies, and the structure and evolution of the universe as a whole. Fall.

Co-requisite: SMTE 0095.

TCCNS: PHYS 1303

PHYS 1304 Introduction to Astronomy: Solar System

3 Semester Credit Hours (2 Lecture Hours, 2 Lab Hours)

This is one of two courses in the introduction to astronomy sequence which emphasizes the nature of astronomical phenomena over the mathematical analysis of them. This course introduces astronomical phenomena related to the Solar System such as apparent motion of the Sun, phases of the Moon and apparent and true motion of the planets. Main focus will be on the objects comprising the Solar System: planets, their moons, asteroids, comets and trans-Neptunian bodies. A portion of the course will be dedicated to the formation and development of the Solar System and other, extrasolar planetary systems. The course also will touch the aspects of human exploration of the Solar System and the role of technology in our learning and understanding of the Solar System. This includes the history and the basics of robotic and manned spaceflights. Offered every Spring and Summer.

Co-requisite: SMTE 0095.

TCCNS: PHYS 1304

PHYS 1401 General Physics I

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

Introduction to Newtonian physics. Topics include Aristotelian physics and its overthrow, Newton's laws of motion and gravitation, and the motion of particles, rigid bodies and fluids. The idea of the universe as a law-governed system will be developed. Laboratory activities provide introduction to empirical methods in science. Fall, Spring, Summer.

Prerequisite: (MATH 1314, 1316*, 1324*, 1325*, 1442, 2312*, 2413*, 2414*, 2415*, minimum score of 21 in 'ACT1 Math', minimum score of 550 in 'SAT Math', minimum score of 21 in 'ACT Math' or minimum score of 550 in 'SAT1 Mathematics').

* May be taken concurrently.

Co-requisite: SMTE 0095.

TCCNS: PHYS 1401

PHYS 1402 General Physics II

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

Introduction to oscillatory and wave phenomena, electricity and magnetism. The classical theory of fields will be used to study electric and magnetic phenomena, including light, and their role in modern technology. Laboratory activities provide introduction to empirical methods in science. Fall, Spring, Summer.

Prerequisite: (PHYS 1401 or 2425).

Co-requisite: SMTE 0095.

TCCNS: PHYS 1402

PHYS 2425 University Physics I

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

A calculus based introduction to Newtonian physics. Topics include Aristotelian physics and its overthrow, Newton's laws of motion and gravitation, and the motion of particles, rigid bodies, and fluids. The idea of the universe as a law-governed system will be developed. Laboratory activities provide introduction to empirical methods in science. Fall, Spring, Summer.

Prerequisite: MATH 2413.

Co-requisite: SMTE 0095.

TCCNS: PHYS 2425

PHYS 2426 University Physics II

4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)

Calculus based introduction to oscillatory and wave phenomena, electricity and magnetism. The classical theory of fields will be used to study electric and magnetic phenomena, including light, and their role in modern technology. Fall, Spring, Summer.

Prerequisite: PHYS 2425 and MATH 2414.

Co-requisite: SMTE 0095.

TCCNS: PHYS 2426

PHYS 3331 Mechanics I

3 Semester Credit Hours (3 Lecture Hours)

Fundamentals of classical mechanics. Topics include particle dynamics in one, two and three dimensions: conservation laws; dynamics of a system of particles; motion of rigid bodies; central force problems; accelerating coordinate systems; Newton's theory of gravitation; Lagrange's and Hamilton's formulations of classical mechanics. This course is offered through the Texas Physics Consortium (TPC). See their website (<http://www.tarleton.edu/tpc/>) for details. Fall.

Prerequisite: PHYS 2426 and MATH 3315*.

* May be taken concurrently.

PHYS 3332 Electromagnetism

3 Semester Credit Hours (3 Lecture Hours)

Electrostatics; Laplace's equation; the theory of dielectrics; magnetostatic fields; electromagnetic induction; magnetic fields of currents; Maxwell's equations. This course is offered through the Texas Physics Consortium (TPC). See their website (<http://www.tarleton.edu/tpc/>) for details. Fall.

Prerequisite: PHYS 2426 and (MATH 3315* or 2415*).

* May be taken concurrently.

PHYS 3333 Thermodynamics

3 Semester Credit Hours (3 Lecture Hours)

Concept of temperature, equations of state; the first and the second law of thermodynamics; entropy; change of phase; the thermodynamics functions. This course is offered through the Texas Physics Consortium (TPC). See their website (<http://www.tarleton.edu/tpc/>) for details. Fall.

Prerequisite: PHYS 2426 and MATH 2415*.

* May be taken concurrently.

PHYS 3334 Modern Physics I

3 Semester Credit Hours (3 Lecture Hours)

A course in special relativity and elementary quantum mechanics. Topics include relativistic description of space-time, relativistic energy and momentum, the uncertainty principle, Schrödinger's equation, observables and operators, bound states, potential barriers, and the quantum description of the hydrogen atom. This course is offered through the Texas Physics Consortium (TPC). See their website (<http://www.tarleton.edu/tpc/>) for details. Fall, Spring.

Prerequisite: PHYS 2426 and MATH 3315*.

* May be taken concurrently.

PHYS 3490 Selected Topics**1-4 Semester Credit Hours (1-4 Lecture Hours)**

Subject materials will be chosen from Electromagnetic Field Theory, Thermodynamics, Mathematical Methods of Physics, Waves and Optics, Advanced Modern Physics, Quantum Theory, Computational Physics, Geophysics, Environmental Physics and Medical Physics. May be repeated for credit if topics selected are different. This course will be used for upper-level physics electives offered from other Texas Physics Consortium (TPC) schools. See their website (<http://www.tarleton.edu/tpc/>) for details. Fall, Spring. Prerequisites vary.

PHYS 4085 Major Field Test in Physics**0 Semester Credit Hours**

The Major Field Test (MFT) in Physics is a national examination given to physics students in their last semester. It is a graduation requirement for all students in the Texas Physics Consortium students obtaining the Joint BS in Physics. Students enroll in this course during the semester that they plan to take the MFT and graduate. There is no cost to the student for either this course or for the MFT.

Prerequisite: PHYS 4162* and 4337*.

* May be taken concurrently.

PHYS 4161 Physics Research Project**1 Semester Credit Hour (1 Lecture Hour)**

The first half of a two semester sequence. The student will work with a faculty member to develop and conduct a senior research project including a search of the relevant literature and presentation of the proposed research idea. This course is offered through the Texas Physics Consortium (TPC). See their website (<https://web.tarleton.edu/tpc/>) for details. Fall.

Prerequisite: PHYS 3334.

PHYS 4162 Physics Research Seminar**1 Semester Credit Hour (1 Lecture Hour)**

The second half of a two semester sequence. The student will work with a faculty member to conduct a senior research project including giving an oral presentation of the final results and writing up the results in a form suitable for publication. This course is offered through the Texas Physics Consortium (TPC). See their website (<https://web.tarleton.edu/tpc/>) for details. Spring.

Prerequisite: PHYS 4161.

PHYS 4330 Mathematical Methods for Physicists**3 Semester Credit Hours (3 Lecture Hours)**

Mathematical techniques from the following areas: infinite series; integral transforming; applications of complex variables; vectors, matrices, and tensors; special functions; partial differential equations; Green's functions; perturbation theory; integral equations; calculus of variations; and groups and group representatives. This course offered through the Texas Physics Consortium (TPC). See their website (<https://web.tarleton.edu/tpc/>) for details. Spring.

Prerequisite: MATH 3315*.

* May be taken concurrently.

PHYS 4335 Quantum Physics**3 Semester Credit Hours (3 Lecture Hours)**

The Schroedinger equation; one dimensional systems; the Heisenberg uncertainty principle; magnetic moments and angular momentum; two and three dimensional systems; approximation methods; spin. This course is offered through the Texas Physics Consortium (TPC). See our website (<https://web.tarleton.edu/tpc/>) for details. Fall.

Prerequisite: PHYS 3334 and (MATH 3315* or 2415*).

* May be taken concurrently.

PHYS 4337 Nuclear Physics**3 Semester Credit Hours (3 Lecture Hours)**

The study of nuclear phenomena and properties including mass, stability, magnetic moment, radioactive decay processes and angular momentum. The use of nuclear techniques as applied to other scientific fields including electronics and medicine. This course is offered through the Texas Physics Consortium (TPC). See our website (<https://web.tarleton.edu/tpc/>) for details. Spring.

Prerequisite: PHYS 3334 and 4335* and (MATH 3315* or 2415*).

* May be taken concurrently.

PHYS 4340 Advanced Physics Lab**3 Semester Credit Hours (1 Lecture Hour, 4 Lab Hours)**

A laboratory course focusing on experimental design, advanced data analysis and reduction, and experimental laboratory techniques and instrumentation. Experiments will be drawn from a variety of physics areas. This course is offered through the Texas Physics Consortium (TPC). See our website (<https://web.tarleton.edu/tpc/>) for details. Spring.

Prerequisite: PHYS 3334*.

* May be taken concurrently.

Co-requisite: SMTE 0095.

PHYS 4496 Directed Independent Study**1-4 Semester Credit Hours (1-4 Lecture Hours)**

Requires a formal proposal of study to be completed in advance of registration and to be approved by the supervising faculty, the Chairperson, and the Dean of the College.