

Division of Chemistry and Physics

The Division of Chemistry and Physics provides rigorous, high-caliber programs with experts dedicated to student mastery. Located only an hour southwest of Fort Worth in the heart of Stephenville, campus is nestled in the Hill Country of Texas, with access to nearby facilities and research opportunities in DFW, Austin, Waco, Abilene, and College Station.

Learning reaches beyond the classroom at Tarleton, and we are proud of our traditions of friendliness and of treating students with respect and individual attention. We take pride in our small advanced classes which provided access to our faculty in a one-on-one environment. Tarleton's faculty members are dedicated to your needs and they make every effort to be responsive and progressive.

These traits are also present in Tarleton's Division of Chemistry and Physics, which offers Bachelor of Science degrees in Physics (<https://www.tarleton.edu/degrees/bachelors/bs-physics/>), and Chemistry (<https://www.tarleton.edu/degrees/bachelors/bs-chemistry/>).

The Bachelor of Science Degree in Chemistry

Chemistry is for students with the desire to be a part of the future and the drive to test established thought. Students who like to work with both their hands and their minds will enjoy the challenge and excitement of this creative science. Chemists work with highly sophisticated instruments, with computers, with basic lab ware and chemicals, and with other people.

Over 60% of all chemists work in industry, producing the products and technologies that shape our everyday lives - pharmaceuticals, textiles, rubber, glass, polymers, paper, conductors, and food. In the industrial environment a chemist may be working in research, inventing or improving a chemical compound or process. Other chemists are involved in manufacturing a product or running experiments to test the quality or safety of products.

More than 20 % of all chemists are engaged in teaching and/or research in schools, colleges, and universities. Chemists in educational institutions enjoy the challenge of communicating the excitement of chemistry to new generations.

Federal, state, and local governments employ about 10 % of the chemistry work force. These chemists work in a variety of governmental agencies on issues dealing with science and technology, health care, the environment, defense, and industry. Individuals with degrees in chemistry are also found working in many diverse fields such as medicine, technical writing, law, information science, agriculture, health and safety, instrumentation, sales and personnel work, management, manufacturing, library science, engineering, environmental protection, forensics, materials science, and as small business owners.

Many chemistry graduates enter the job market directly; however, approximately 60% of graduates elect post-graduate study. Approximately 10,000 men and women receive an undergraduate degree in chemistry annually; however, this number has dropped somewhat in recent years, and the National Science Foundation has expressed much concern about whether there will be sufficient numbers of trained chemists in the future.

The demand for chemists remains strong in the 21st century as society moves into a more highly developed technological age dependent on materials and the science that produces them.

Accredited by the American Chemical Society, the Bachelor of Science degree in Chemistry prepares students for graduate studies or careers in the scientific community or academia.

The Bachelor of Science Degree in Chemistry

Required Courses

Placement for Calculus 1 is by the CLMPE placement exam, or by college credit for MATH 1316 or MATH 2412. Contact Tarleton's Center for Academic Testing for test information and locations.

General Education Requirements (http://catalog.tarleton.edu/academicaffairs/):	43
CHEM 1311 [shared] College Chemistry I (Lecture)	
CHEM 1111 [shared] College Chemistry I (Laboratory)	
CHEM 1312 [shared] College Chemistry II (Lecture)	
CHEM 1112 [shared] College Chemistry II (Laboratory)	
CHEM 2323 Organic Chemistry I	3
CHEM 2123 Organic Chemistry I Laboratory	1
CHEM 2325 Organic Chemistry II	3
CHEM 2125 Organic Chemistry II Laboratory	1
CHEM 3407 Quantitative Analysis	4
CHEM 3423 [WI (http://catalog.tarleton.edu/academicaffairs/)] Physical Chemistry I	4
CHEM 4160 Professional Lab Safety Techniques and Ethics in Chemistry	1
CHEM 4408 Instrumental Analysis	4
ENGL 1301 [shared] [WI (http://catalog.tarleton.edu/academicaffairs/)] Composition I	
ENGL 1302 [shared] [WI (http://catalog.tarleton.edu/academicaffairs/)] Composition II	
ENGL 3309 [WI (http://catalog.tarleton.edu/academicaffairs/)] Professional Writing	3
MATH 2413 [shared] Calculus I	
MATH 2414 Calculus II	4
Total Hours	71

Additional Required Courses for Concentrations

Biochemistry

BIOL 1406 Biology for Science Majors	4
BIOL 1407 Biology for Science Majors II	4
BCIS or COSC Elective	3
BIOL 3407 Microbiology	4
BIOL 3303 Genetics	3
BIOL 3103 Genetic Techniques	1
BIOL 3413 Molecular Biology	4
CHEM 4327 Structural Organic Analysis	3

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or CHEM 4345	Medicinal Chemistry	
CHEM 4328	Inorganic Chemistry	3
CHEM 3324	Physical Chemistry II	3
CHEM 4374	Biochemistry I	3
CHEM 4375	Biochemistry II	3
BIOL 4378	Biochemistry Lab	3
PHYS 1401	College Physics I	4
PHYS 1402	College Physics II	4

Total Hours **49**

Forensic Chemistry

CRIJ 1301	Introduction to Criminal Justice	3
CRIJ 1306	Court Systems and Practices	3
BIOL 1406	Biology for Science Majors	4
BIOL 3407	Microbiology	4
MATH 3450	Principles of Bio-Statistics	4
CHEM 4327	Structural Organic Analysis	3
CHEM 4374	Biochemistry I	3
CHEM 4378	Biochemistry Lab	3
CRIJ 3305	Criminology	3
CHEM 4328	Inorganic Chemistry	3
CRIJ 3315	Rules of Criminal Evidence	3
CRIJ 4316 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Methods of Criminal Justice Research	3
Advanced CHEM elective		2
PHYS 1401	College Physics I	4
PHYS 1402	College Physics II	4
COMM 2302 [shared]	Business and Professional Speaking	

Total Hours **49**

Interdisciplinary

Select one of the following: 4

GEOL 1403	Physical Geology	
GEOL 1404	Historical Geology	
GEOL 1407	Introduction to Environmental Science	
BIOL 1406	Biology for Science Majors	
BIOL 1407	Biology for Science Majors II	

Supporting field (14 Hours Advanced) ¹ 21

Advanced Electives 8

Advanced CHEM Electives 1

PHYS 1401	College Physics I	4
PHYS 1402	College Physics II	4
COMM 2302 [shared]	Business and Professional Speaking	
CHEM 4328	Inorganic Chemistry	3
CHEM 3124	Physical Chemistry II Laboratory	1
CHEM 3324	Physical Chemistry II	3

Total Hours **49**

Pre-Health

BIOL 1406	Biology for Science Majors	4
BIOL 1407	Biology for Science Majors II	4
ECON 2301 [shared]	Principles of Macroeconomics	
PSYC 2301	General Psychology	3
or PSYC 2314	Life Span Growth & Development	
BIOL 3407	Microbiology	4
BIOL 3303	Genetics	3
BIOL 3103	Genetic Techniques	1
BIOL 3413	Molecular Biology	4
MATH 3450	Principles of Bio-Statistics	4
CHEM 4345	Medicinal Chemistry	3
CHEM 4374	Biochemistry I	3
CHEM 4375	Biochemistry II	3
Advanced CHEM Electives		5
PHYS 1401	College Physics I	4
PHYS 1402	College Physics II	4
COMM 2302 [shared]	Business and Professional Speaking	

Total Hours **49**

Professional Chemistry

Advanced Electives		6
BIOL 1406	Biology for Science Majors	4
BIOL 1407	Biology for Science Majors II	4
CHEM 4327	Structural Organic Analysis	3
CHEM 4328	Inorganic Chemistry	3
CHEM 4374	Biochemistry I	3
CHEM 4378	Biochemistry Lab	3
CHEM 3324	Physical Chemistry II	3
CHEM 3124	Physical Chemistry II Laboratory	1
CHEM 4086	Chemistry Problems: Undergraduate Research	1-4
Electives		4
Advanced Chemistry Electives		6
COMM 2302 [shared]	Business and Professional Speaking	
PHYS 2425	University Physics I	4
PHYS 2426	University Physics II	4

Total Hours **49**
Environmental Chemistry

GEOL 1403	Physical Geology	4
GEOL 1407	Introduction to Environmental Science	4
BIOL 1406	Biology for Science Majors	4
EASC 3350	Environmental Science	3
BIOL 3407	Microbiology	4
MATH 3450	Principles of Bio-Statistics	4
SOIL 3101	Soil Science Laboratory	1
SOIL 3301	Soil Science	3
EASC 4313 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Environmental Techniques	3
CHEM 4327	Structural Organic Analysis	3
CHEM 4328	Inorganic Chemistry	3
CHEM 4477	Environmental Chemistry	4
Advanced Chemistry Elective		1
COMM 2302 [shared]	Business and Professional Speaking	
PHYS 1401	College Physics I	4
PHYS 1402	College Physics II	4

Total Hours **49**

¹ Possible support fields include biology, geoscience, physics, business administration, and other fields approved by department heads involved

Physics

Physics is the science that investigates and tries to understand the basic laws of nature. In this pursuit, it deals with the entire range of natural phenomena from the smallest domain of sub-nuclear particles to the largest domain of distant objects in the universe. This breadth of interests is reflected in the type of work pursued by physicists. Some are interested in research on problems that are at the frontiers of knowledge. Some apply this newly acquired knowledge to make practical advances in fields like engineering. Still others use the knowledge of physics as a basis for careers in medicine, law, teaching or administration. The Tarleton physics program is one of the best equipped undergraduate programs in Texas with state-of-the-art undergraduate research facilities including a 32" robotic telescope and 1 MV tandem particle accelerator. The physics program provides several different tracks including medical physics for students interested in medicine, dentistry, or medical physics and an astronomy track so that students can tailor the program to meet their educational goals. By adding two or three additional courses with a support area of mathematics or computer science, a student in the classical can obtain a second bachelors degree in their support area. For students interested in teaching at the high school level, secondary (grades 8-12) certification in either Physical Science or Math/Physics is available. Through Tarleton's membership in the Texas Electronic Coalition for Physics and students may take upper-level elective physics courses from professors across the Texas A&M System. Through Tarleton's membership in the Nuclear Power Institute students may take nuclear engineering courses from Texas A&M's nuclear engineering department to prepare the student for entry into nuclear engineering graduate program.

Joint B.S. Degree in Physics**Field of Study Courses**

Field of Study 18 hrs (at least 6 hrs Advanced)	18
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Other Required Courses

General Education Requirements (http://catalog.tarleton.edu/academicaffairs/)	43	
PHYS 2425 [shared]	University Physics I	
PHYS 2426 [shared]	University Physics II	
PHYS 3331	Mechanics I	3
PHYS 3332	Electromagnetic Field Theory	3
PHYS 3333 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Thermodynamics	3
PHYS 3334	Modern Physics I	3
PHYS 4330	Mathematical Methods for Physicists and Engineers	3
PHYS 4335	Quantum Physics	3

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PHYS 4337 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Nuclear Physics and Techniques	3
PHYS 4340 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Advanced Physics Laboratory	3
PHYS 4161 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Physics Research Project	1
PHYS 4162 [WI (http://catalog.tarleton.edu/academicaffairs/)]	Physics Research Seminar	1
MATH 2413 [shared]	Calculus I	
MATH 2414	Calculus II	4
MATH 3433	Calculus III	4
MATH 3306	Differential Equations	3
Advanced Physics Electives - 6 hrs		6
COSC Elective - 3 hrs		3
Electives 13 hours		13

Academic Advising Guides

Academic Advising Guides area available at the following website:

<https://web.tarleton.edu/majorinfo/>

Chemistry Courses

CHEM 1111. College Chemistry I (Laboratory). 1 Credit Hour (Lecture: 0 Hours, Lab: 3 Hours).

Basic laboratory experiments supporting theoretical principles presented in CHEM 1311; introduction of the scientific method, experimental design, data collection and analysis, and preparation of laboratory reports. Prerequisite: MATH 1314; Corequisite: CHEM 1311 Lab fee: \$2.

CHEM 1112. College Chemistry II (Laboratory). 1 Credit Hour (Lecture: 0 Hours, Lab: 3 Hours).

Basic laboratory experiments supporting theoretical principles presented in CHEM 1312; introduction of the scientific method, experimental design, chemical instrumentation, data collection and analysis, and preparation of laboratory reports. Prerequisite: MATH 1314; CHEM 1111 or 1411; Coreq with CHEM 1312 Lab fee: \$2.

CHEM 1302. Essential Elements of Chemistry. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).

An introduction to the science of chemistry with a broad overview of the essential elements of chemistry and real-life applications. Enrollment in this course is restricted to Interdisciplinary Studies majors. Lab fee: \$2.

CHEM 1311. College Chemistry I (Lecture). 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Fundamental principles of chemistry for majors in the sciences, health sciences, and engineering; topics include measurements, fundamental properties of matter, states of matter, chemical reactions, chemical stoichiometry, periodicity of elemental properties, atomic structure, chemical bonding, molecular structure, solutions, properties of gases, and an introduction to thermodynamics and descriptive chemistry. Prerequisite: MATH 1314.

CHEM 1312. College Chemistry II (Lecture). 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Chemical equilibrium; phase diagrams and spectrometry; acid-base concepts; thermodynamics; kinetics; electrochemistry; nuclear chemistry; an introduction to organic chemistry and descriptive inorganic chemistry. Prerequisite: CHEM 1311 or CHEM 1411, MATH 1314.

CHEM 1407. Fundamentals of Chemistry. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).

A beginning chemistry course for students in applied sciences who need only one semester of general chemistry. The course includes the structure, properties and changes in matter, quantitative relationships in reactions, solutions, equilibrium, pH, buffers and nuclear chemistry. Not recommended for science majors or pre-professional students in health related fields. Does not meet prerequisite for CHEM 1412 or 2423. Lab fee: \$2.

CHEM 1409. College Chemistry for Engineers. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

Introduction to important concepts and principles of chemistry with an emphasis on areas considered most relevant in an engineering context. Registration will be restricted to engineering majors only. Engineering students many not receive credit for both CHEM 1409, CHEM 1311 and 1111, and CHEM 1411. Prerequisite: MATH 1314, or MATH 2412, or MATH 2413, or concurrent enrollment. Lab fee: \$2.

CHEM 2123. Organic Chemistry I Laboratory. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).

Laboratory portion associated with lecture CHEM 2323 Prerequisites: CHEM 1312 and 1112 or CHEM 1409(for Engineering Majors only) prerequisite or co-enrollment in CHEM 2323 Lab fee: \$2.

CHEM 2125. Organic Chemistry II Laboratory. 1 Credit Hour (Lecture: 0 Hours, Lab: 4 Hours).

Laboratory portion associated with lecture CHEM 2325 Prerequisite: CHEM 2123; CHEM 2323; prerequisite or co-enrollment in CHEM 2325 Lab fee: \$2.

CHEM 2323. Organic Chemistry I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

The first semester of a year sequence in the chemistry of carbon compounds involving their synthesis, reaction mechanisms, nomenclature, physical and spectral properties. Includes compounds of theoretical, biological, agricultural, and industrial importance. Prerequisites: CHEM 1312 and 1112 or CHEM 1409(for Engineering Majors only).

CHEM 2325. Organic Chemistry II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

A continuation of CHEM 2323. The laboratory includes an introduction to qualitative organic analysis. This course is a prerequisite to all organic chemistry courses at the junior or higher level. Prerequisite: CHEM 2323 (2423).

CHEM 2423. Organic Chemistry I. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).

The first semester of a year sequence in the chemistry of carbon compounds involving their synthesis, reaction mechanisms, nomenclature, physical and spectral properties. Includes compounds of theoretical, biological, agricultural, and industrial importance. Prerequisites: CHEM 1312 and 1112 or CHEM 1409(for Engineering Majors only) Lab fee: \$2.

CHEM 2425. Organic Chemistry II. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours).

A continuation of Organic Chemistry I (CHEM 2323 and CHEM 2123). The laboratory includes an introduction to qualitative organic analysis. This course is a prerequisite to all organic chemistry courses at the junior or higher level. Prerequisites: CHEM 2423 or both CHEM 2323 and CHEM 2123. Lab fee: \$2.

CHEM 3124. Physical Chemistry II Laboratory. 1 Credit Hour (Lecture: 0 Hours, Lab: 3 Hours).

A laboratory introduction to the microscopic properties of nature, including an introduction to quantum mechanics and its applications to atomic and molecular spectroscopy. Prerequisite: CHEM 3423 Lab fee: \$2.

CHEM 3314. Geochemistry. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).

A survey of the application of chemical principles to problems of geology. Topics include the origin and distribution of the elements in addition to exploring the behavior and distribution of various elements in igneous, metamorphic, and sedimentary rocks. Basic concepts of thermodynamics, solution chemistry, and isotope geochemistry will be discussed. Credit for both CHEM 3314 and GEOL 3314 will not be awarded. Prerequisites: CHEM 1312 and 1112. Lab fee: \$2.

CHEM 3324. Physical Chemistry II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

An introduction to the microscopic properties of nature, including an introduction to quantum mechanics and its applications to atomic and molecular spectroscopy. Prerequisite: CHEM 3423.

CHEM 3407. Quantitative Analysis. 4 Credit Hours (Lecture: 2 Hours, Lab: 6 Hours).

A study of the experimental and theoretical principles concerning gravimetric and volumetric analysis. Topics include data treatment, equilibrium, precipitation, neutralization, oxidation, reduction, potentiometry, and introduction to spectroscopy. Prerequisite: A grade of C or better in 8 hours of freshman CHEM; junior classification or approval of department head. Lab fee: \$10.

CHEM 3423. Physical Chemistry I. 4 Credit Hours (Lecture: 3 Hours, Lab: 4 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]

A study of chemical thermodynamics and its application to chemical equilibrium; the macroscopic properties of matter including real gases, solutions, and phase changes; chemical kinetics. Prerequisite: MATH 2414; PHYS 1402 or 2426 or approval of department head. Lab fee: \$2.

CHEM 4086. Chemistry Problems: Undergraduate Research. 1-4 Credit Hours (Lecture: 0 Hours, Lab: 1-4 Hours).

Conducting an undergraduate research project in Chemistry. May be repeated for credit. A maximum of four hours may be applied toward degree requirements in chemistry. Prerequisite: Approval of department head.

CHEM 4160. Professional Lab Safety Techniques and Ethics in Chemistry. 1 Credit Hour (Lecture: 1 Hour, Lab: 1 Hour).

A capstone course intended for a chemistry major to take during their senior year. Lectures will cover the issues of ethics and lab safety in chemistry as well as the societal impacts of chemistry. The lab portion will be devoted to analyzing case studies, doing literature research, and giving professional style presentations. Prerequisite: Student must be within one year of graduation. Lab fee: \$2.

CHEM 4327. Structural Organic Analysis. 3 Credit Hours (Lecture: 1 Hour, Lab: 6 Hours).

The identification of the principal classes of organic compounds. Prerequisites: CHEM 2425 or both CHEM 2325 and CHEM 2125. Lab fee: \$2.

CHEM 4328. Inorganic Chemistry. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Discussion of the models of inorganic chemistry including atomic structure, chemical bonding, periodic properties, stereochemistry, reaction mechanisms, and coordination chemistry. Properties of specific elements and families are also presented. Prerequisites: CHEM 2425 or both CHEM 2325 and CHEM 2125, and junior classification or approval of department head.

CHEM 4329. Polymers. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

A basic study of polymer chemistry, with special emphasis on the effect of the structure of monomers upon the structure of the polymers, is presented. Prerequisites: CHEM 2425 or both CHEM 2325 and CHEM 2125.

CHEM 4345. Medicinal Chemistry. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

An examination of the principles of drug action including receptor-effector theories and the effects of physico-chemical properties on biological activity. The principles of drug design, synthesis, and metabolism will be presented. Prerequisites: CHEM 2425 or CHEM 2325 and CHEM 2125, and BIOL 1407.

CHEM 4374. Biochemistry I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

An introduction to the basic principles of biological chemistry and to fundamental processes of plants, animals, and microorganisms. Credit for both BIOL 4374 and CHEM 4374 will not be awarded. Prerequisites: One semester of organic chemistry (2 semesters recommended), and 8 hours of biological science or approval of department head.

CHEM 4375. Biochemistry II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

A detailed survey of intermediary metabolism. The metabolism of carbohydrates, lipids, proteins and nucleic acids, and the regulation of metabolism are emphasized. Credit for both BIOL 4375 and CHEM 4375 will not be awarded. Prerequisite: BIOL/CHEM 4374, or approval of department head.

CHEM 4378. Biochemistry Lab. 3 Credit Hours (Lecture: 1 Hour, Lab: 6 Hours).

Principles and applications of basic methodology for the isolation, purification, characterization, and quantitative determination of biologically important compounds. Credit for both BIOL 4378 and CHEM 4378 will not be awarded. Prerequisite: BIOL 4374 or CHEM 4374 or concurrent enrollment, or approval of the department head. Lab fee: \$2.

CHEM 4408. Instrumental Analysis. 4 Credit Hours (Lecture: 2 Hours, Lab: 6 Hours).

A study of the theory and use of instruments for chemical analysis. Techniques include absorption spectroscopy, nuclear magnetic resonance, atomic absorption, flame emission, mass spectroscopy, chromatography, potentiometry, and polarography. Prerequisites: CHEM 3407 and 1 semester of organic chemistry or approval of department head. Lab fee: \$2.

CHEM 4477. Environmental Chemistry. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

This is an undergraduate course intended for any student who has completed College chemistry 1 and college chemistry II with an interest towards Environmental Science. This course includes both lecture and laboratory components. Lectures will cover topics which provide the understanding of interactions between chemical compounds whether anthropogenic or natural with the ecosystem. This course will provide qualitative and quantitative knowledge on effects of changes in water, soil, air and its effects on the environment. The lab portion includes bench scale and field scale experiments to put theory to practice. Water and soil samples will be collected from different sources and lab made samples will be used to detect and analyze the various types of pollutants and their mitigation methods will be discussed. Prerequisites: CHEM 1312 and 1112. Lab fee: \$2.

Physics Courses

PHYS 1302. Essential Elements of Physics. 3 Credit Hours (Lecture: 2 Hours, Lab: 3 Hours).

This course introduces fundamental physics and astronomy concepts to students planning to become elementary and middle school teachers. Students are expected to design and conduct inquiry based experiments including the development of hypothesis, collection and analysis of data, and the use of appropriate laboratory equipment. Topics include motion, forces, energy, waves, light, electricity, magnetism, stellar and planetary evolution, and the atom. Enrollment in this course is restricted to Interdisciplinary Studies majors. Prerequisite: MATH 1314. Lab fee: \$2.

PHYS 1401. College Physics I. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

An introduction to mechanics, heat, and wave motion. This course is a trigonometry-based physics course. A student cannot get credit for PHYS 1401 if credit has been previously received for PHYS 2425. Prerequisite: MATH 1316, MATH 2412, MATH 2413 or concurrent enrollment. Lab fee: \$2.

PHYS 1402. College Physics II. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

An introduction to electricity and magnetism, light, and modern physics. This is a trigonometry-based physics course. Prerequisite: PHYS 1401. A student cannot get credit for PHYS 1402 if credit has previously been received for PHYS 2426. Lab fee: \$2.

PHYS 1403. Stars and Galaxies. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

A laboratory science course of study in topics of astronomy and astrophysics, including the sun and its source of energy, stellar formation and evolution, black holes, galaxies, cosmology, and the creation and evolution of the universe. Prerequisite: two semesters of high school algebra or MATH 0304. Lab fee: \$2.

PHYS 1410. Great Ideas of Physics. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

Great Ideas of Physics is a laboratory science course designed to introduce the student to the concepts of physics in an elementary mathematical setting, and to discuss their significance to science, technology, and society. Topics will be drawn from both classical and contemporary physics. Prerequisite: Two semesters of high school algebra or MATH 0304. This course cannot be used for credit toward a degree in physics or mathematics. Lab fee: \$2.

PHYS 1411. Introductory Astronomy I. 4 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).

A laboratory science course of study in the topics of astronomy and astrophysics, including the history of astronomy, Kepler's laws, gravitation, formation of the solar system, asteroids, comets, meteors, a detailed survey of the planets and their evolution, and discussion on the possibility of extraterrestrial life in the universe. Prerequisite: Two semesters of high school algebra or MATH 0304. Lab fee: \$2.

PHYS 2425. University Physics I. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

This is an introduction to mechanics, heat, and wave motion. This is a calculus-based physics course. Prerequisite: MATH 2413 or concurrent registration. Lab fee: \$2.

PHYS 2426. University Physics II. 4 Credit Hours (Lecture: 3 Hours, Lab: 3 Hours).

This is an introduction to electricity, magnetism, optics, and modern physics. Prerequisites: PHYS 2425 and MATH 2414 or concurrent registration. Lab fee: \$2.

PHYS 3331. Mechanics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Particle dynamics in one, two, and three dimensions; conservation laws; dynamics of a system of particles; motion of rigid bodies; central force problems. Prerequisites: PHYS 2426; MATH 3306 and MATH 3433 or concurrent registrations.

PHYS 3332. Electromagnetic Field Theory. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Electrostatics; Laplace's equation; the theory of dielectrics; magnetostatic fields; electromagnetic induction; magnetic fields of currents; Maxwell's equations. Credit for both ELEN 3332 and PHYS 3332 will not be awarded. Prerequisites: PHYS 2426, MATH 3306 and MATH 3433, or concurrent registrations.

PHYS 3333. Thermodynamics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]

Concept of temperature, equations of state; the first and the second law of thermodynamics; entropy; change of phase; the thermodynamics functions. Prerequisite: PHYS 2426 (Prerequisite); MATH 3433 (Co-requisite).

PHYS 3334. Modern Physics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Foundations of the atomic theory of matter; kinetic theory; elementary particles; radiations; atomic model; atomic structure; atomic spectra and energy levels; quantum theory of radiation; x-rays; special theory of relativity. Prerequisite: PHYS 2426 (Prerequisite); MATH 3433 or MATH 3306 (Corequisite).

PHYS 3350. Medical Physics I. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

The course will provide an introduction to the physics of human physiological processes as well as the physics used in the design of medical diagnostic tools and techniques. Prerequisite: PHYS 2426 or consent of the instructor.

PHYS 4086. Special Problems. 1-6 Credit Hours (Lecture: 0 Hours, Lab: 1-3 Hours).

This course is designed to develop the theoretical or experimental capabilities, or both, of individual senior physics majors. Prerequisites: Senior classification and approval of department head.

PHYS 4161. Physics Research Project. 1 Credit Hour (Lecture: 1 Hour, Lab: 2 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]

Literature survey and preparation for, and initiation of, a research project agreed to between the student and a faculty advisor, to be completed and reported on in the Research Seminar course. Prerequisite: PHYS 3334.

PHYS 4162. Physics Research Seminar. 1 Credit Hour (Lecture: 1 Hour, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]

An experimental or theoretical project will be continued by the student and the results reported in a seminar. Students who have not yet taken the ETS Physics field test are required to do so while enrolled in Seminar. Prerequisite: PHYS 4161.

PHYS 4303. Astronomy and Astrophysics. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).

A laboratory science course of study in the topics of astronomy and astrophysics, including Planetary Astronomy, Stellar Astrophysics, Galactic Astronomy, Cosmology and Astrobiology. Prerequisite: MATH 2413, PHYS 2425. Lab fee: \$2.

PHYS 4330. Mathematical Methods for Physicists and Engineers. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 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. Credit for both ENPH 4330 and PHYS 4330 will not be awarded. Prerequisite: MATH 3306, 3433.

PHYS 4332. Optics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

Huygen's principle applied to geometric optics; interference; diffraction; polarization; crystal optics; electromagnetic theory of light; interaction of light with matter. Prerequisites: PHYS 2442 and MATH 3306.

PHYS 4334. Modern Physics II. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

The constitution of the atomic nucleus; natural radioactivity; artificially induced nuclear transmutations; alpha, beta, and gamma decay; nuclear reactions; nuclear structure and nuclear forces; nuclear fission; neutron physics. Prerequisites: PHYS 3334 and MATH 3306 or concurrent registration.

PHYS 4335. Quantum Physics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

The Schrodinger equation; one dimensional systems; the Heisenberg uncertainty principle; magnetic moments and angular momentum; two and three dimensional systems; approximation methods; scattering theory. Prerequisite: PHYS 3334 (Prerequisite); MATH 3306 or MATH 3433 (Co-requisite).

PHYS 4336. Solid State Physics. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours).

The basic ideas of physics are applied to the understanding of the properties of crystalline materials to include the definition of such materials, electrical and thermal conductivity, heat capacity, crystalline binding, the nature of metals, insulators, and semiconductors, dielectric properties, and magnetic properties. Credit for both ELEN 4336 and PHYS 4336 will not be awarded. Prerequisite: PHYS 3334; MATH 3306 or concurrent registration.

PHYS 4337. Nuclear Physics and Techniques. 3 Credit Hours (Lecture: 3 Hours, Lab: 0 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**PHYS 4340. Advanced Physics Laboratory. 3 Credit Hours (Lecture: 1 Hour, Lab: 4 Hours). [WI (<http://catalog.tarleton.edu/academicaffairs/>)]**

A laboratory course focusing on advanced techniques and experiments drawn from the full range of physics classes. The student will understand the role of experimental design, advanced data analysis and reduction, error analysis, and the use of computers while investigating physical phenomena. Prerequisite: Corequisite: PHYS 3334. Lab fee: \$30.

PHYS 4350. Medical Physics II. 3 Credit Hours (Lecture: 3 Hours, Lab: 2 Hours).

The course covers the physics of ionizing radiation and its application in areas of medical physics, radiation safety, and manufacturing. Prerequisite: PHYS 3334 or consent of instructor. Lab fee: \$8.

PHYS 440. Advanced Physics Laboratory. 3 Credit Hours (Lecture: 1 Hour, Lab: 4 Hours).

A laboratory course focusing on advanced techniques and experiments drawn from the full range of physics classes. The student will understand the role of experimental design, advanced data analysis and reduction, error analysis, and the use of computers while investigating physical phenomena. Co-requisite: PHYS 3334.