

Undergraduate Handbook

This handbook is designed to serve as a guide for the Physics major. It contains information on the major, department, courses, and faculty.

Advisor Contact Points

The undergraduate advisor in physics is Dr. Wallace Glab.

To discuss a major, minor, or courses in physics contact him at the following:

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Texas Tech University

Department of Physics

Undergraduate Program

Horn Professor: Estreicher; Bucy Professor: Wigmans; Professors: Akchurin, Borst, Cheng, Huang, Holtz, Lichti, Lodhi, and Myles.; Associate Professors: Gibson, Glab, Grave de Peralta, Lamp, Sanati, and Thacker; Assistant Professors: Clark, Lee, Park, and Volobouev.

This department supervises the Bachelor of Science, Master of Science, and Doctor of Philosophy degrees in physics. The department also supervises an applied physics option in the MS and PhD degrees.

The Bachelor of Science degree can be taken in any of four areas of concentration, to be described below. These concentrations allow a student to tailor his or her studies towards their particular career goals. Please refer to the sample course schedules below for details about each concentration. A physics major should declare to the department which concentration they choose by the beginning of their junior year.

Majors in this department are required to maintain a minimum grade point average of 2.00 in physics courses and required adjunct courses, and receive a C or better in each of these courses. Students also have a variety of university and College of Arts & Sciences requirements that must be met. The minimum number of hours to attain a degree in physics in each of the various concentrations is 120. Credit for any transferred physics hours will be handled on an individual basis with the department's undergraduate advisor.

Students are strongly encouraged to devote time to undergraduate research. Research areas in the department include atomic, molecular, and optical physics, condensed matter physics, nuclear physics, physics education, particle physics, astronomy, and biophysics.

The Physics B.S. curricula are designed around the assumption that physics students will minor in mathematics. However, a variety of other minors that complement study in physics can be selected. Choice of a minor other than mathematics may require that a student complete more than 120 hours for their degree.

B.S. in Physics, professional concentration: A traditional curriculum for a physics major, intended to prepare the student for going on to graduate study, or for seeking employment in the private or government sectors as a physicist. A typical sequence of courses begins with PHYS 1408, 2401, 2402, and 2305 for a total of 15 hours at the introductory level. These are usually followed by the intermediate and advanced sequences, PHYS 3304, 3305, 3306, 3401, 4302, 4304, and 4307. Students desiring to pursue advanced degrees are recommended to take advanced topic courses.

The required mathematics courses for physics majors are MATH 1451, 1452, 2450, 3350 and 3351. MATH 3354 and 4354 may be substituted for 3350 and 3351. Students planning to pursue an advanced degree in physics should consult the physics undergraduate advisor about appropriate additional courses.

B.S. in Physics, Astrophysics concentration: A variation of the professional concentration for students who have particular interest in astronomy and astrophysics intended to prepare students who, in addition to the possible employment paths associated with the professional concentration, may want to pursue graduate study in astronomy or astrophysics. This concentration has the same mathematics requirements as the professional option, very similar physics course requirements (with one less

required upper level PHYS course), and also includes 14 hours of ASTR courses. Majors in this concentration are strongly encouraged to minor in mathematics. Choice of a different minor will result in a student needing to take more than 120 hours to complete their degree. Students are strongly encouraged to devote time to undergraduate research.

B.S. in Physics, Applied Physics concentration: A variation of the professional concentration for students who wish to pursue more applied work, such as graduate study or employment in engineering fields. It requires the same coursework as the professional option, with an addition 9 required hours of an applied specialty. Again, majors in this concentration are strongly encouraged to minor in mathematics. Choice of a different minor will result in a student needing to take more than 120 hours to complete their degree. Students are strongly encouraged to devote time to undergraduate research.

B.S. in Physics, secondary education concentration: A curriculum intended to train students for teaching physics and/or mathematics at the secondary education level. It provides a four-year path to certification for teaching these fields at the middle school and high school levels. This concentration will enable a graduate to go directly from this program into teaching math and/or physics at the secondary education level. Students selecting this option should expect to take additional hours of advanced physics coursework if they wish to be well prepared for further graduate study in physics, or seeking employment as a physicist. Coursework for this concentration includes 12 hours of introductory physics courses, a one-hour fieldwork course, 12 hours of additional Junior/Senior level physics courses, 24 hours of mathematics courses, and 27 hours of education courses, all of which apply to the attainment of secondary teacher certification in the Math/Physics content area.

Minors for Physics majors: A broad variety of minor subjects may be elected by a student majoring in physics. These include mathematics, biochemistry, physical chemistry, geophysics, computer science, business, and electrical engineering. A frequent minor choice for Physics majors is mathematics, the requirements for which are automatically satisfied by the sequence of MATH courses required for a Physics major. Students contemplating minors outside of the College of Arts & Sciences should seek the advice of the physics undergraduate advisor before beginning that minor.

Minor in Physics: A minor in physics by majors outside of physics requires 18 semester hours of which at least 6 must be at the 3000 level or higher and must be approved by the undergraduate advisor. The minor sequence is PHYS 1408, 2401, and 2402 plus 6 hours of approved 3000+ courses. Students must receive a grade of C or better in all courses applied toward a minor. The astronomy courses (ASTR 1400 and 1401) may not be used to satisfy requirements for the physics major or minor.

Students are encouraged to participate in the Society of Physics Students, which sponsors several academic and social activities.

Sample schedules for each concentration

B. S. in Physics, Professional concentration: Sample Four-Year Curriculum

First Year

<i>Fall</i>		<i>Spring</i>	
Social and Behavioral Sciences	3	PHYS 1408, Principles of Physics I	4
MATH 1451, Calculus I	4	MATH 1452, Calculus II	4
ENGL 1301, Essentials of Coll. Rhetoric	3	ENGL 1302, Advanced Coll. Rhetoric	3
Personal Fitness and Wellness	1	Personal Fitness and Wellness	1
COMS 2300, Public Speaking	3	Visual and Performing Arts	3
TOTAL	14	TOTAL	15

Second Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2401, Principles of Physics II	4	PHYS 2402, Principles of Physics III	4
MATH 2450, Calculus III	4	MATH 3350, Math for Engrns.&Scien. ¹	3
POLS 1301, American Govt. Org.	3	POLS 2302, American Public Policy	3
Humanities	3	Foreign Language ³	3
Foreign Language ³	3	Multicultural	3
TOTAL	17	TOTAL	16

Third Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2305, Computation for Phys. Sci.	3	PHYS 4304, Mechanics	3
PHYS 3401, Optics	4	Elective	3
MATH 3351, Math for Engrns.&Scien. ¹	3	Physics elective ²	3
HIST 2300, History of the U.S. to 1877	3	HIST 2301, Hist. of the U.S. Since 1877	3
		ENGL 23--	3
TOTAL	13	TOTAL	15

Fourth Year

<i>Fall</i>		<i>Spring</i>	
PHYS 3305, Electricity and Magnetism	3	PHYS 3306, Electricity and Magnetism	3
PHYS 4307, Quantum Mechanics	3	PHYS 3304, Intermediate Exp. Physics	3
Physics elective ²	3	PHYS 4302, Statistical and Thermal	3
Elective	3	Elective	3
ENGL 23--	3	Elective	3
TOTAL	15	TOTAL	15

TOTAL HOURS 120

¹ May be substituted for with MATH 3354 (Differential Equations I) and MATH 4354 (Differential Equations II)

² Physics electives are offered in alternate years. Consult the current Physics Undergraduate Handbook at www.phys.ttu.edu for current scheduling.

³ A student must complete six hours at the sophomore level or above in a single language. The prerequisite for all sophomore language courses is credit for the freshman level. This credit can be determined through a placement or CLEP exam. Failure to pass either exam will mean enrolling in a 5-hour review course during the first year or, in some cases, enrolling for both beginning (first-year) language courses. See Arts and Sciences General Degree Requirements for further explanation.

Professional concentration students are strongly encouraged to minor in Mathematics, as assumed in the curriculum above. Choice of a different minor may require taking courses beyond 120 hours.

B. S. in Physics, Astrophysics concentration: Sample Four-Year Curriculum

First Year

<i>Fall</i>		<i>Spring</i>	
Social and Behavioral Sciences	3	PHYS 1408, Principles of Physics I	4
MATH 1451, Calculus I	4	MATH 1452, Calculus II	4
ENGL 1301, Essentials of Coll. Rhetoric	3	ENGL 1302, Advanced Coll. Rhetoric	3
Personal Fitness and Wellness	1	Personal Fitness and Wellness	1
COMS 2300, Public Speaking	3	Visual and Performing Arts	3
TOTAL	14	TOTAL	15

Second Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2401, Principles of Physics II	4	PHYS 2402, Principles of Physics III	4
MATH 2450, Calculus III	4	MATH 3350, Math for Engrns.&Scien. ¹	3
POLS 1301, American Govt. Org.	3	POLS 2302, American Public Policy	3
Humanities	3	Foreign Language ²	3
Foreign Language ²	3	HIST 2300, History of the U.S. to 1877	3
TOTAL	17	TOTAL	16

Third Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2305, Computation for Phys. Sci.	3	PHYS 4304, Mechanics	3
(PHYS 3401, Optics ³)	4	PHYS 3302, Cosmophysics	3
PHYS 3305, Elec. and Mag. I	3	(PHYS 3306, Elect. and Mag. II ³)	3
MATH 3351, Math for Engrns.&Scien. ¹	3	ASTR 2401, Observational Astronomy	4
Multicultural	3	ASTR 1401, Stellar Astronomy	4
TOTAL	12 (16)	TOTAL	14 (17)

Fourth Year

<i>Fall</i>		<i>Spring</i>	
ASTR 4301, Astrophysics I	3	ASTR 4302, Astrophysics II	3
PHYS 4307, Quantum Mechanics	3	PHYS 3304, Intermediate Exp. Physics	3
HIST 2301, Hist. of the U.S. Since 1877	3	PHYS 4312, Nuclear and Particle	3
ENGL 23--	3	ENGL 23--	3
TOTAL	12	PHYS 4302, Statistical Physics	3
		TOTAL	15

TOTAL HOURS 118 (119)⁴

¹ May be substituted for with MATH 3354 (Differential Equations I) and MATH 4354 (Differential Equations II)

² A student must complete six hours at the sophomore level or above in a single language. The prerequisite for all sophomore language courses is credit for the freshman level. This credit can be determined through a placement or CLEP exam. Failure to pass either exam will mean enrolling in a 5-hour review course during the first year or, in some cases, enrolling for both beginning (first-year) language courses. See Arts and Sciences General Degree Requirements for further explanation.

³ Students may choose between PHYS 3306 and PHYS 3401 based on their preference, but at least one of these courses is required.

⁴ 120 hours are required for graduation. Students may pick any elective courses they wish to reach 120 hours.

Astrophysics concentration students are strongly encouraged to minor in Mathematics, as assumed in the curriculum above. Choice of a different minor may require taking courses beyond 120 hours.

B. S. in Physics, Applied Physics concentration: Sample Four-Year Curriculum

First Year

<i>Fall</i>		<i>Spring</i>	
Social and Behavioral Sciences	3	PHYS 1408, Principles of Physics I	4
MATH 1451, Calculus I	4	MATH 1452, Calculus II	4
ENGL 1301, Essentials of Coll. Rhetoric	3	ENGL 1302, Advanced Coll. Rhetoric	3
Personal Fitness and Wellness	1	Personal Fitness and Wellness	1
COMS 2300, Public Speaking	3	Visual and Performing Arts	3
TOTAL	14	TOTAL	15

Second Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2401, Principles of Physics II	4	PHYS 2402, Principles of Physics III	4
MATH 2450, Calculus III	4	MATH 3350, Math for Engrns.&Scien. ¹	3
POLS 1301, American Govt. Org.	3	POLS 2302, American Public Policy	3
Humanities	3	Foreign Language ³	3
Foreign Language ³	3	Multicultural	3
TOTAL	17	TOTAL	16

Third Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2305, Computation for Phys. Sci.	3	PHYS 4304, Mechanics	3
PHYS 3401, Optics	4	Engineering or Applied Physics ⁴	3
MATH 3351, Math for Engrns.&Scien. ¹	3	Engineering or Applied Physics ⁴	3
HIST 2300, History of the U.S. to 1877	3	HIST 2301, Hist. of the U.S. Since 1877	3
		ENGL 23--	3
TOTAL	13	TOTAL	15

Fourth Year

<i>Fall</i>		<i>Spring</i>	
PHYS 3305, Electricity and Magnetism	3	PHYS 3306, Electricity and Magnetism	3
PHYS 4307, Quantum Mechanics	3	PHYS 3304, Intermediate Exp. Physics	3
Physics elective ²	3	PHYS 4302, Statistical and Thermal	3
Engineering or Applied Physics ⁴	3	Physics elective ²	3
ENGL 23--	3	Elective	3
TOTAL	15	TOTAL	15

Total Hours 120

¹ May be substituted for with MATH 3354 (Differential Equations I) and MATH 4354 (Differential Equations II)

² Physics electives are offered in alternate years. Consult the current Physics Undergraduate Handbook at www.phys.ttu.edu for current scheduling.

³ A student must complete six hours at the sophomore level or above in a single language. The prerequisite for all sophomore language courses is credit for the freshman level. This credit can be determined through a placement or CLEP exam. Failure to pass either exam will mean enrolling in a 5-hour review course during the first year or, in some cases, enrolling for both beginning (first-year) language courses. See Arts and Sciences General Degree Requirements for further explanation.

⁴ These courses should be selected in consultation with, and approved by, the Physics undergraduate advisor.

Applied Physics concentration students are strongly encouraged to minor in Mathematics, as assumed in the curriculum above. Choice of a different minor will require taking courses beyond 120 hours.

B.S. in Physics: Concentration in Math/Physics Secondary Education Sample Four-Year Curriculum

First Year

<i>Fall</i>		<i>Spring</i>	
MATH 1451, Calculus I	4	PHYS 1408, Principles of Physics I	4
EDSE 2300, Schools, Society, and Diversity	3	MATH 1452, Calculus II	4
ENGL 1301, Essentials of Coll. Rhetoric	3	ENGL 1302, Advanced Coll. Rhetoric	3
HIST 2300, History of the U.S. to 1877	3	HIST 2301, Hist. of U.S. Since 1877	3
Personal Fitness and Wellness	1	Personal Fitness and Wellness	1
POLS 1301, American Govt. Org.	3		
TOTAL	17	TOTAL	15

Second Year

<i>Fall</i>		<i>Spring</i>	
PHYS 2401, Principles of Physics II	4	PHYS 2402, Principles of Physics III	4
MATH 2450, Calculus III	4	MATH 3350, Higher Math Sci & Engr I3	3
COMS 2300, Public Speaking	3	Physics elective ²	3
Foreign Language ¹	3	Foreign Language ¹	3
PHYS 1171, Physics Fieldwork	1	MATH 4331, Adv Geometry	3
TOTAL	15	TOTAL	16

Third Year

<i>Fall</i>		<i>Spring</i>	
MATH 3310, Intro to Proof	3	ENGL 23--	3
EDSE 4322, Diversity	3	MATH 3342, Statistics	3
POLS 2302, American Public Policy	3	Social and Behavioral Sciences	3
ENGL 23--	3	EDSE 4310, Adolescent	3
Visual and Performing Arts	3	PHYS 4373 (WI)	3
		PHYS elective ²	3
TOTAL	15	TOTAL	18

Fourth Year

<i>Fall</i>		<i>Spring</i>	
EDLL 4382, Secondary Classroom	3	EDSE 4330, Capstone	3
EDSE 4311, Curriculum	3	EDSE 4000, Student Teaching	9
PHYS 4371, (EDSE 4376) (WI)	3		
Humanities	3		
TOTAL	12	TOTAL	12

TOTAL HOURS 120

¹ A student must complete six hours at the sophomore level or above in a single language. The prerequisite for all sophomore language courses is credit for the freshman level. This credit can be determined through a placement or CLEP exam. Failure to pass either exam will mean enrolling in a 5-hour review course during the first year or, in some cases, enrolling for both beginning (first-year) language courses. See Arts and Sciences General Degree Requirements for further explanation.

² These electives can be any of a number of junior/senior level physics courses. Students should consult with the Physics undergraduate advisor when choosing these electives.

Scheduling of Physics Course Offerings

The following courses are offered every long semester and summer session: ASTR 1400, PHYS 1408, PHYS 2401.

PHYS 2402, 3000, 4000, 4306, and ASTR 1401 are offered every long semester.

Other courses are offered as shown in the listing below.

Odd Falls

2305 Computation for the Physical Sciences

3305 E&M I

3401 Optics

4307 Quantum I

4309 Solid State

ASTR 4301, Astrophysics I

Even Springs

3302 Cosmological Physics

3306 E&M II

3304 Intermediate Experimental Physics

4301 Computational

4302 Statistical

4304 Mechanics

ASTR 2401, Observational Astronomy

ASTR 4302, Astrophysics II

Even Falls

2305 Computation for the Physical Sciences

3305 E&M I

3401 Optics

4307 Quantum I

ASTR 4301, Astrophysics I

Odd Springs

3304 Intermediate Experimental Physics

3306 E&M II

4302 Statistical

4304 Mechanics

ASTR 2401, Observational Astronomy

ASTR 4302, Astrophysics II

4308 Quantum II

4312 Nuclear and Particle

Physics Major

Degree Plan Worksheet

I. General Education

English (12 hours) ENGL 1301 ENGL 1302 ENGL 23-- ENGL 23--

Oral Communication (3 hours) COMS 1300 or 2300

Foreign Language (11 -16 hours)

Math (8 hours) MATH 1451 MATH 1452

Science (8 hours) PHYS 1408 PHYS 2401

History (6 hours) HIST 2300 HIST 2301

Political Science (6 hours) POLS 1301 POLS 2302

Individual or Group Behavior (3 hours)

Humanities (3 hours)

Visual and Performing Arts (3 hours)

Multicultural (3 hours)

Personal Fitness and Wellness (2 hours)

This menu of courses is required by Tech for any student seeking an A&S degree. The basic pattern is defined by the state and SACS. Courses for the various categories can be found near page 40 of the Undergraduate Catalog.

IIa. Physics Major: PHYS courses for the Professional concentration (37 hours)

PHYS 2305 Computation for the Physical Sciences
PHYS 1408 Principles I- Mechanics
PHYS 2401 Principles II- E&M
PHYS 2402 Principles III- Modern
PHYS 3304 Intermediate Experimental Physics
PHYS 3305 E&M I
PHYS 3306 E&M II
PHYS 3401 Optics
PHYS 4302 Statistical
PHYS 4304 Mechanics
PHYS 4307 Quantum Mechanics

Choose 3 or more hours

PHYS 3000 Undergraduate Research
PHYS 3302 Cosmophysics
PHYS 4000 Independent Study
PHYS 4301 Computational
PHYS 4306 Senior Project
PHYS 4308 Quantum Mechanics II
PHYS 4309 Solid State
PHYS 4312 Nuclear and Particle
ASTR 4301 Astrophysics I
ASTR 4302 Astrophysics II

IIIa. Math (necessary for any physics degree)

MATH 1451 Calculus I
MATH 1452 Calculus II
MATH 2450 Calculus III
MATH 3350 Higher Math for Scientists and Engineers I (or 3354)
MATH 3351 Higher Math for Scientists and Engineers II (or 4354)

Students in the Professional concentration are assumed to minor in mathematics. Another choice of minor may result in requiring additional course hours beyond 120.

Iib. Physics Major: PHYS courses for the Astrophysics concentration (37 hours)

PHYS 2305 Computation for the Physical Sciences
PHYS 1408 Principles I- Mechanics
PHYS 2401 Principles II- E&M
PHYS 2402 Principles III- Modern
PHYS 3302 Cosmophysics
PHYS 3304 Intermediate Experimental Physics
PHYS 3305 E&M I
PHYS 3401 Optics **or** PHYS 3306 E&M II
PHYS 4302 Statistical
PHYS 4304 Mechanics
PHYS 4307 Quantum Mechanics
PHYS 4312 Nuclear and Particle Physics

ASTR courses

ASTR 1401 Stellar Astronomy
ASTR 2401 Observational Astronomy
ASTR 4301 Astrophysics I
ASTR 4302 Astrophysics II

MATH requirements are the same as for the Professional concentration.

Students in the Astrophysics concentration are assumed to minor in mathematics. Another choice of minor may result in requiring additional course hours beyond 120.

Iic. Course requirements for the Applied Physics concentration

PHYS requirements are the same as for the Professional concentration

MATH requirements are also the same as for the Professional concentration

This concentration requires an additional 9 hours minimum of courses that constitute applied physics or engineering courses. These courses must be approved by the departmental advisor.

Students in the Applied Physics concentration are assumed to minor in mathematics. Another choice of minor may result in requiring additional course hours beyond 120.

IId. Course requirements for the Secondary Education Concentration

PHYS courses

PHYS 1408 Principles I- Mechanics
PHYS 2401 Principles II- E&M
PHYS 2402 Principles III- Modern
PHYS 1171 Physics Fieldwork
PHYS 4371 Physics as it is Taught (WI)
PHYS 4373 Math Modeling in Physics (WI)

Plus 2 of the following courses:

PHYS 3304 Intermediate Experimental Physics
PHYS 3305 E&M I
PHYS 3306 E&M II
PHYS 3401 Optics
PHYS 4301 Computational
PHYS 4302 Statistical
PHYS 4304 Mechanics
PHYS 4307 Quantum Mechanics
PHYS 4372 Astronomy as it is Taught

MATH courses

MATH 1451 Calculus I
MATH 1452 Calculus II
MATH 2450 Calculus III
MATH 3310 Introduction to Proof
MATH 3342 Statistics
MATH 3350 Higher Math for Scientists and Engineers I
MATH 4331 Advanced Geometry

Education courses

EDSE 2300 Schools, Society, and Diversity
EDSE 4310 Adolescent
EDSE 4322 Diversity
EDLL 4382 Secondary Classroom
EDSE 4311 Curriculum
EDSE 4000 (9 hours) Student Teaching
EDSE 4330 Secondary Capstone

Students in this concentration will be able to take a minor in mathematics or education without additional coursework.

Physics Department Course Descriptions

1171. Physics Fieldwork (1:0:3). Interaction with public school teachers and students in delivering a limited lesson for students. Tech student will learn and implement a lesson. Intended for students who may be interested in the Secondary Education concentration.

1304. Physics: Basic Ideas and Methods (3:3:0). Intended to provide physics background to pre-engineering students. Examines basic concepts in physics. Problem-solving techniques, graphical representations, and pertinent mathematics. [PHYS 1310]

1401. Physics for Nonscience Majors (4:3:2). Course intended to acquaint students with the basic laws and vocabulary of physics. A minimum of mathematics is used.

1402. Physics of Living Matter (4:3:2). Covers the physics principles found in living matter and techniques useful in biomedical sciences. Not for physics majors.

1403, 1404. General Physics (4:3:3 each). Prerequisite: MATH 1320 and 1321. A non-calculus introductory physics course designed to provide students with a background for further study in science and related areas. Covers mechanics, heat, sound, electricity and magnetism, light, and modern physics.

1406. Physics of Sound and Music (4:3:3). A qualitative course designed to acquaint the student with the principles of physics used in the production of sound and music. A minimum of mathematics will be used. Some of the physical principles are exemplified in laboratory sessions. Satisfies natural science requirement in Arts and Sciences.

1408. Principles of Physics I (4:3:3). Prerequisite: MATH 1451. Calculus-based introductory physics course. Mechanics, kinematics, energy, momentum, gravitation, waves, and thermodynamics. (Honors section offered.)

2305. Computation for the Physical Sciences (3:3:0). Prerequisite: PHYS 1408 and 2401. Introduces computational tools to solve science problems. Emphasizes interplay between technology application and practical learning

2401. Principles of Physics II (4:3:3). Corequisite: MATH 1452. Calculus-based introductory physics. Electric and magnetic fields, electromagnetic waves, and optics. (Honors section offered.)

2402. Principles of Physics III (4:3:3). Prerequisite: PHYS 2401. Study of atomic, molecular, and nuclear phenomena. Relativity, quantum effects, hydrogen atom, many electron atoms, and some molecular physics. Includes laboratory.

3000. Undergraduate Research (V1-6). Individual and/or group research projects in basic or applied physics, under the guidance of a faculty member.

3302. Cosmophysics: the universe as a physics lab (3:3:0). Prerequisite: 2402. This course deals with topics from astrophysics, cosmology, and cosmic ray physics of interest to all physicists.

3304. Intermediate experimental physics (3:0:6). Corequisite: PHYS 2402. Laboratory course on advanced physical principles, including experiments in optics, atomic, molecular, solid state, and nuclear physics (writing intensive).

3305, 3306. Electricity and Magnetism (3:3:0 each). Prerequisite: PHYS 2401 and either MATH 3350 or Math 3354. Maxwell's equations, electrostatics, dielectric materials. Magnetic fields and materials. Electromagnetic waves, radiation. Relativity.

3400. Fundamentals of Physics (4:3:3). Prerequisite: MATH 1320. Development of basic concepts of physics: Astronomy, motion, density, sound, electricity, magnetism, atoms, light, and radioactivity. Not for engineering, science, or mathematics majors.

3401. Optics (4:2:4). Prerequisite: PHYS 2401. Geometrical and physical optics with emphasis on the latter. Waves, reflection, scattering, polarization, interference, diffraction, modern optics, and optical instrumentation (writing intensive).

4000. Independent Study (V1-4). Prerequisite: Approval of advisor. Study of advanced topics of current interest under direct supervision of a faculty member.

4301. Computational Physics (3:2:2). Prerequisite: PHYS 1408, 2401, 2402. Numerical modeling of physical systems. Data acquisition and analysis. Graphics for displaying complex results. Quadrature schemes, solution of equations. Use of microcomputers in assignments.

4302. Statistical and Thermal Physics (3:3:0). Prerequisite: PHYS 2402 and knowledge of differential equations. Introduction to statistical methods in physics. Formulation of thermodynamics and statistical mechanics from a unified viewpoint with applications from classical and quantum physics.

4304. Mechanics (3:3:0). Prerequisite: PHYS 1408, 2401, or equivalent, and differential equations. Dynamics of particles and extended bodies, both rigid and fluid, using Newtonian mechanics and the Euler-Lagrange equations from Hamilton's principle. Nonlinear systems and chaos with numerical modeling. Applications of the Navier-Stokes equation.

4306. Senior Project (3). Prerequisite: Senior standing in physics or engineering physics. Individual research project under the guidance of a faculty member (writing intensive).

4307. Introduction to Quantum Mechanics (3:3:0). Prerequisite: MATH 3350. Experimental and conceptual bases. Dualism, uncertainty principle. Mathematical framework. Schrödinger equation, solutions. Hydrogen atom. Pauli principle, spin. Periodic table. Perturbation theory.

4308. Quantum Mechanics II (3:3:0). Prerequisite: PHYS 4307. Review of quantum mechanics, time-independent and dependent perturbation theory, variational principle, WKB approximation, the adiabatic approximation and scattering.

4309. Solid State Physics (3:3:0). Prerequisite: PHYS 3305 and knowledge of elementary quantum mechanics. The structural, thermal, electric, and magnetic properties of crystalline solids. Free electron theory of metals. Concept of energy bands and elementary semiconductor physics.

4312. Nuclear and Particle Physics (3:3:0). Prerequisite: PHYS 4307. This is a course dealing with modern nuclear physics covering such topics as nuclear structure models, radioactivity, nuclear reactions, elementary particles, nuclear conservation, forces, and symmetry.

4371. Physics as it is taught (3:2:3). Discusses the teaching of introductory material. Extends topic coverage into advanced treatments and mathematics. Designed for students seeking teaching certification.

4372. Astronomy as it is Taught (3:3:0). Discusses solar system, stellar, and galactic astronomy and develops the use of activities in the process of instruction. Designed for students seeking teaching certification.

4373. Math Modeling in Physics (3:3:0). Motivates the extensive use of mathematics in the practice of physics and teaching physics. Designed for students seeking teaching certification.

Astronomy Courses

ASTR 1400. Solar System Astronomy (4:3:2). Structure of the solar system. Gravitation, light, and orbits of the solar system. Planets and their moons, asteroids, and comets. (Honors section offered.)

ASTR 1401. Stellar Astronomy (4:3:2). Structure, models of the universe. Stellar evolution. Gravitation, light, orbits of the stars and galaxies. Endpoints of stellar evolution. (Honors section offered.)

ASTR 2401. Observational Astronomy (4:2:2). Prerequisite: ASTR 1400 or 1401 or consent of instructor. Designed for anyone interested in learning the use of an optical telescope, both visually and for imaging.

ASTR 4301. Astrophysics I (3:3:0). Prerequisites: PHYS 4304, ASTR 1401, MATH 2350. Introduction to the tools of Astronomy, stellar properties, stellar structure, and stellar evolution.

ASTR 4302. Astrophysics II (3:3:0). Prerequisite: ASTR 4301. Planets and planetary systems, types and evolution of galaxies, cosmology, and the early universe.

Faculty Members

Nural Akchurin – Prof. 2000, Ph.D. Iowa 1990. Particles.

Walter Borst – Prof. 1984, Ph.D. Berkeley 1968. Atomic and molecular.

Kelvin Cheng – Prof. 1988, Ph.D. Waterloo 1983. Biophysics.

Maurice Clark - Assistant Professor 2010

Stefan Estreicher – Horn Prof. 1986, Ph.D. Zurich 1982. Solid state.

Tom Gibson – Associate Prof. 1985, Ph.D. Oklahoma 1982. Atomic and molecular.

Wallace Glab – Associate Prof. 1990, Ph.D. Illinois 1984. Atomic and molecular.

Luis Grava de Peralta – Associate Prof. 2007, Ph.D. TTU 2000. Solid state.

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