

**PHTH580****Professional Ethics**

Basic ethical theory and methods and their place in the study of human behavior. Medical professional context and challenges of ethical behavior are examined including the relationships between peers, superiors, subordinates, and patients. Contemporary medical ethical issues are discussed and illustrated with actual cases and related to Christian biblical presuppositions.

**PHTH587****Applied Movement Science: Norwegian Concepts**

The metabolic activity level of different tissue types described, compared, and contrasted. Sources of fuel for energy production described and related to the specificity of exercise training, tissue remodeling, and regeneration. Concepts used to plan a physiologically correct rehab program for differing pathologies.

**PHTH648****Workshop**

(2)

(2.5)

(1-4)

# PHYSICS

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**Faculty**

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Academic Programs	Credits
BS: Physics	40
BS: Biophysics	42
Minor in Physics	20

Physics describes the world in terms of matter and energy and relates the many facets of its phenomena in terms of fundamental law. Its scope includes systems that range in size from sub-nuclear to the entire cosmos. A major in physics supports and enhances professional careers in engineering, the life sciences, the physical sciences, and similar areas.

A major in biophysics prepares the graduate for advanced studies in medical and bioengineering fields. Both physics programs prepare the graduate for a career in secondary teaching.

## Undergraduate Programs

**BS: Physics—40**

**Major Requirements:** PHYS241, 242, 271, 272, 377, 411, 430, 431, 477, 481, 495 plus an additional 12 credits numbered 300 and above.

**Cognate Courses:** MATH141, 142, 240, 281, 286; CHEM131, 132; and CPTR125 (FORTRAN) or CPTR151.

Physics majors desiring secondary-teaching certification should consult with the department and with the School of Education.

**Recommended Electives:** ELCT141, 142, TCED250.

**BS: Biophysics—42**

**Offered by the biology and physics departments**

BIOL165, 166, 371; 372 or BCHM421\*; BIOL348; PHYS241, 242, 271, 272, 377, 411, 416, 430 or CHEM431 and 441, PHYS377, 431, 495

\* A student may earn a minor in chemistry by selecting the biochemistry option.

**Cognate Courses—27**

CHEM131, 132, 231, 232; MATH141, 142, 286.

**Recommended Electives:** BCHM421, 430; CHEM432, 442; ELCT141, 142; MATH240, 281.

Students electing to take a BS: Biophysics should consult with the chair of the Physics Department. Biophysics majors who are interested in secondary teaching need to select electives in the sciences to meet certification requirements.

Such persons should consult with the biophysics adviser and the School of Education early in their programs.

**Minor in Physics—20**

Chosen in consultation with the department including PHYS241, 242, and 271, 272.

*PHYS110, 115, 131, 132, 405 are not applicable to a major or minor in Physics.*

## Graduate Program

The Physics Department collaborates in the MS: Interdisciplinary Studies (Mathematics and Physical Sciences). See the Interdisciplinary Studies section, p. 96.

## Courses

(Credits)

See inside front cover for symbol code.

**PHYS110** \$ (3)**Astronomy**

Explores the cosmic environment. Topics include the solar system, stars and their development star clusters, the interstellar medium, galaxies, and the large-scale features of the universe. Meets the natural science elective course requirement.

Weekly: 2 lectures, 1 recitation, and a 2-hour lab.

Prerequisite: MATH 165 or its equivalent.

**PHYS110** V (3)**Astronomy**

Distance education—see content above.

**PHYS115** Alt \$ (3)**Concepts of Physics**

A conceptual approach to physics for the non-science student. Explores matter, energy, motion, waves, electricity, and magnetism and quantum physics. Meets the natural science elective course requirement. Weekly: 2 lectures, 1 recitation, and a 2-hour lab. Prerequisite: MATH 165 or equivalent.

**PHYS130** \$ (4)**Applied Physics for Health Professions**

Mechanics, waves, electricity, magnetism, acoustics and optics as applied to health professions such as Physical Therapy, but not acceptable for admission to dental, medical or veterinary schools. Weekly: 3 lectures, 1 recitation, and one 3-hr lab. Prerequisite: MATH 165.

**PHYS141, 142** \$ (4, 4)**General Physics**

Algebra based introduction to mechanics, relativity, heat, electricity, magnetism, wave motion, physical and geometric optics, and modern physics. Weekly: 3 lectures, 1 recitation, 1 laboratory briefing lecture, and one 3-hour lab. Prerequisite: MATH165.

**PHYS241, 242** (4, 4)**Physics for Scientists and Engineers**

An introduction to mechanics, relativity, heat, electricity, magnetism, wave motion, physical and geometrical optics, and modern physics emphasizing the mathematical formulation and the physical significance of the fundamental

principles. Weekly: 4 lectures and 1 recitation.  
Prerequisites: MATH141, 142. Corequisites:  
PHYS271, 272.

**PHYS271, 272** § (1,1)  
**Physics for Scientists Laboratory**  
Weekly: one 3-hour lab. Corequisites: PHYS241,  
242.

**PHYS280** (1-3)  
**Topics in \_\_\_\_\_**  
Introductory-level topics in astrophysics, high-  
energy physics, or other areas of current interest.  
Repeatable to 4 credits. Minimum of 4 hours  
work per week is required for each credit earned.  
Approval of the instructor is required.

**PHYS295** (1-2)  
**Independent Study / Research**  
Reading and lab projects (i.e., holography and  
astrophotography). Repeatable to 4 credits. A  
minimum of 4 hours work per week is required  
for each credit earned. Approval of the instructor  
is required.

**PHYS350** Alt (2.5)  
**Optics**  
Geometrical and physical optics; interference and  
diffraction, polarization, Fourier optics, lasers, and  
holography. Prerequisites: PHYS242  
(recommended) or 142; MATH142.

**PHYS377** § (1)  
**Advanced Physics Laboratory I**  
Development of advanced lab skills in the study of  
basic physical phenomena. Emphasis includes  
scientific instrumentation, lab procedure, data  
reduction, interpretation, and technical  
communication. Students in full-year sequences of  
upper division physics courses enroll for at least 2  
semesters. Repeatable to 2 credits.

**PHYS400** ? (1-2)  
**Demonstrations in Physics**  
Consideration of topics suitable for demonstration,  
a survey of the literature, prepared  
demonstrations, suppliers of materials and  
equipment. A critical evaluation of  
demonstrations—their design, preparation, and  
execution—with student participation.  
Prerequisite: Approval of the department.

**PHYS405** Alt ? (3)  
**Acoustics of Music and Hearing**  
Investigation of the properties of sound with  
respect to structure of musical sounds, production  
by musical instruments and human vocal chords,  
sound intensity and hearing, reverberation, and  
auditorium acoustics. For persons interested in a  
better understanding of music, speech, and  
hearing. Cannot be applied toward a major or  
minor in physics. Weekly: 2 lectures and a 2-hour  
lab. Prerequisite: MATH165 or equivalent.

**PHYS411, 412** Alt-412 ? (2.5, 2.5)  
**Theoretical Mechanics**  
Statics, kinematics, and dynamics of systems of  
particles. Application of vector calculus to  
mechanics; Lagrangian and Hamiltonian  
formulations. Corequisite: PHYS377 or 477.  
Prerequisite: PHYS242 (recommended) or  
PHYS142; MATH142.

**PHYS416** Alt (2.5)  
**Biophysics**

Modeling and describing physical phenomena of  
living systems. Topics deal with transport and  
diffusion across membranes and electrical  
processes in muscle and nerve tissue.

**PHYS420** (2-3)  
**Advanced Topics in \_\_\_\_\_**  
Astrophysics, atomic physics, biophysics, nuclear  
physics, relativity or other areas of current  
interest. Prerequisite: PHYS242 or 411.  
Repeatable to 6 credits.

**PHYS430** Alt ? (2.5)  
**Thermodynamics**  
Systematic introduction to thermodynamics,  
kinetic theory, and statistical mechanics (classical  
and quantum). Prerequisites: PHYS242  
(recommended) or PHYS142; MATH142.  
Corequisite: PHYS377 or 477.

**PHYS431, 432** Alt ? (3,3)  
**Electricity and Magnetism**  
A treatment of electromagnetic phenomena in  
terms of potentials and vector fields. PHYS431  
develops Maxwell's equations with descriptions of  
electrostatics and magnetostatics as solutions to  
Laplace's and Poisson's equations. PHYS432  
addresses electromagnetic radiation in media,  
reflection and refraction, and the fields of wave-  
guides and antennae. Corequisites: PHYS377 or  
477 and PHYS411.

**PHYS445** Alt ? (2.5)  
**Particle Physics**  
A study of particle properties, forces, structure,  
decay and reaction mechanism in the context of  
the Standard Model. Prerequisite: PHYS481  
Corequisite: PHYS377 or 477.

**PHYS460** Alt ? (2.5)  
**Solid State Physics**  
A study of crystallography, x-ray diffraction,  
properties of crystalline and amorphous solids, band  
theory of solids, and lattice dynamics. Prerequisite:  
PHYS411. Corequisite: PHYS377 or 477.

**PHYS475** (2.5)  
**Physics Review**  
A review and synthesis of physics concepts and  
analytical and experimental techniques in  
preparation for entry into a graduate program.  
Topics include classical, statistical and quantum  
mechanics, waves and classical fields. Prerequisite  
PHYS411.

**PHYS477** \$ ? (1)  
**Advanced Physics Laboratory II**  
Acquaints students with important phenomena,  
equipment, and technique of modern experimental  
physics. Students taking a full-year sequence of  
upper division physics courses required to enroll  
for at least 2 semesters. Repeatable to 2 credits.

**PHYS481, 482** Alt ? (3,3)  
**Quantum Mechanics**  
The mechanics of small-scale physical phenomena  
as developed by Heisenberg, Schroedinger, and  
Dirac. Treatment of square well, step, and  
harmonic oscillator potentials; uncertainty  
relations; and symmetries to include angular  
momenta. Corequisites: PHYS377 or 477 and  
PHYS411.

**PHYS495** (1-3)  
**Independent Study/Research**  
Individually directed study or research in selected  
fields of physics. Repeatable to 6 credits. A

minimum of 4 hours work per week is required for  
each credit earned. A written paper required.  
Approval of the instructor required.

**PHYS530** (2-3)  
**Topics in Teaching Physics**  
Each time the course is offered, one of the  
following areas is discussed:  
• Principles of physics and effective approaches  
for teaching them.  
• The physics lab, its purposes, administrative  
and safety procedures, essential equipment,  
seminal experiments, data analysis, lab  
journal, and reports.  
Repeatable to 6 credits.

**PHYS540** (2-3)  
**Topics in Physics**  
Study of one of the traditional areas of graduate  
physics such as electromagnetic theory, analytical  
mechanics, solid state physics, astrophysics,  
mathematical physics, and theoretical physics.  
Students must complete assigned readings and  
problems. Satisfactory performance on a written  
or oral comprehensive exam required. Repeatable  
to 9 credits.

**PHYS648** (1-3)  
**Workshop**

**PHYS690** (1-3)  
**Independent Study/Research**  
Independent problems of research in selected fields  
of physics. Open to qualified students who show  
ability and initiative. Repeatable to 6 credits. A  
minimum of 4 hours work per week  
expected for each credit earned. Prerequisite:  
Consent of department chair.