Physics

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AIMS OF THE PROGRAM

Majoring in physics can be a valuable part of a broad education. Students who combine mastery of the basic principles and methods of physics with the outlook and adaptability provided by a liberal Christian education will find themselves well-prepared for a variety of careers. Recent physics graduates have gone into top graduate and professional schools and have successfully entered careers in industry.

The objectives of the physics program are to prepare majors for a professional career or graduate study, provide the training required by other programs and professional schools, and support the general education program of the University by providing courses of instruction for non-science students.

PROGRAMS

B.S. Mathematical Physics - 52 hours (30 u.d.)
B.S. Physics - 36 hours (25 u.d.)
B.S. Physical Science - Secondary Certification
Physics Minor - 18 hours (6 u.d.)

Mathematical Physics, B.S.

| MATH 181 | Calculus I | 4 |
| MATH 282 | Calculus II | 4 |
| MATH 283 | Calculus III | 4 |
| MATH 321 | Differential Equations | 3 |
| MATH 361 | Introduction to Linear Algebra | 3 |
| MATH 381 | Complex Variables | 3 |
| MATH 411 | Numerical Analysis | 3 |
| MATH 431 | Modern Algebra | 3 |
| MATH 471 | Advanced Calculus | 3 |
| MATH 451 | Statistical Analysis | 3 |
| PHYS 121 | General Physics | 4 |
| PHYS 122 | General Physics | 4 |
| PHYS 221 | General Physics with Calculus | 4 |
| PHYS 222 | General Physics with Calculus | 2 |
| PHYS 305 | Digital Electronics | 4 |
| PHYS 311 | Modern Physics | 3 |
| PHYS 322 | Classical Mechanics | 3 |
| PHYS 351 | Electromagnetic Fields | 3 |
| PHYS 411 | Quantum Mechanics | 3 |
| TOTAL | | 52 |

The B.S. in Mathematical Physics is a composite major, therefore no minor is required.

Physics, B.S.

| PHYS 121 | General Physics | 4 |
| PHYS 122 | General Physics | 4 |
| PHYS 221 | General Physics with Calculus | 4 |
| PHYS 291 | Selected Topics | 1 |
| PHYS 305 | Digital Electronics | 4 |
| PHYS 311 | Modern Physics | 3 |
| PHYS 322 | Classical Mechanics | 3 |
| PHYS 331 | Thermodynamics | 3 |
| PHYS 351 | Electromagnetic Fields | 3 |
| PHYS 352 | Electromagnetic Radiation | 3 |
| PHYS 411 | Quantum Mechanics | 3 |
| PHYS 412 | Advanced Modern Physics | 3 |
| TOTAL | (25 u.d.) | 36 |

Required cognates:

MATH 181, 282, 283, 321; CSIS 110; CHEM 111, 112

Physics Minor

| PHYS 121, 122 | General Physics | 8 |
| PHYS 311 | Modern Physics | 3 |
| PHYS | Electives | 7 |
| TOTAL (6 u.d.) | | 18 |

TEACHING CERTIFICATION PROGRAM

The following Physical Science major is for teaching certification only. Requirements for certification are listed in the Education section of this bulletin.

You must make formal application for admittance to the Teacher Education Program. Applications are available at the Education Department office.

Physical Science with Physics Emphasis, B.S.
Secondary Teaching Area

| PHYS 112 | Introductory Astronomy | 3 |
| PHYS 121, 122 | General Physics | 8 |
| PHYS 221, 222 | General Physics with Calculus | 2 |
| PHYS 311 | Modern Physics | 3 |
| PHYS 322 | Classical Mechanics | 3 |
| PHYS 351 | Electromagnetic Fields | 3 |
| PHYS 352 | Electromagnetic Radiation | 3 |
| PHYS 412 | Advanced Modern Physics | 3 |
| CHEM 111, 112 | General Chemistry | 8 |
| CHEM 331, 332 | Organic Chemistry | 8 |
| CHEM 341 | Physical Chemistry | 4 |
| TOTAL | (27 u.d.) | 48 |
COURSES

PHYS 101  Introductory Physics       3 hours
  A laboratory science course for the student with no previous
  background in physics. A conceptual, rather than mathematical, ap-
  proach is emphasized. Topics include mechanics, heat, sound, electro-
  magnetism, light, and modern physics. 2 Lec 3 Lab. (Fall)

PHYS 112  Introductory Astronomy      3 hours
  An introductory study of the solar system; stellar structure and
evolution; star clusters, galaxies, quasars, the large scale structure of
the universe, and cosmology. A conceptual, rather than mathematical,
approach is emphasized, though some arithmetic calculations are re-
quired. 2 Lec 3 Lab. (Spring)

PHYS 121  General Physics I           4 hours
  Prerequisite: MATH 181
  An introduction to motion in one dimension, vectors in 2 and 3
dimensions, the laws of motion, work and energy, momentum and
collisions, uniform curricular motion, gravity, rotational equilibria and
dynamics involving torque and angular momentum, solids and fluids,
thermal physics and heat, thermodynamical laws, vibrations, waves, and
sound. Math level is algebra and trigonometry. 3 Lec 3 Lab. (Fall)

PHYS 122  General Physics II          4 hours
  Prerequisite: PHYS 121
  Continuation of PHYS 121. Topics include electric force and electric
field, electric potential, capacitance, resistance and resistivity, direct and
alternating currents, Kirchhoff's Laws, Ohm's Law, magnetism and
Amper's Law, Faraday's Law, electromagnetic waves, reflection and
refraction of light, mirrors and lenses, relativity, quantum physics, atomic
and nuclear physics, particles. 3 Lec 3 Lab. (Spring)

PHYS 221  General Physics with Calculus 1 hour
  Prerequisite: MATH 181
  Corequisite: PHYS 121
  A one hour addition to the topics of PHYS 121 where the calculus
is thoroughly used. A student taking PHYS 121 and PHYS 221 will have
the equivalent of a 4-hour university course in calculus-based general
physics (topics as in PHYS 121). (Offered periodically)

PHYS 222  General Physics with Calculus 1 hour
  Prerequisite: MATH 181
  Corequisite: PHYS 121
  A one hour addition to the topics of PHYS 122 where the calculus
is thoroughly used. A student taking PHYS 122 and PHYS 222 will have
the equivalent of a 4-hour university course in calculus-based general
physics (topics as in PHYS 122). (Offered periodically)

PHYS 291  Selected Topics             1 hour
  Prerequisite: Approval of department chair
  Study in areas of interest beyond those listed in the bulletin.
  May include lectures, lab or readings under the direction of staff
  member. Content and method of study to be arranged prior to
  registration. May be repeated for a total of 2 credits.

PHYS 305  Digital Electronics         4 hours
  Prerequisite: Permission of instructor
  An introduction to the theory and application of digital logic
  circuits. Combinatorial and sequential logic design principles and
  practices. Microcomputer interfacing: I/O programming, system bus
  structures and I/O interfaces. 3 Lec 3 Lab. (Fall)

PHYS 311  Modern Physics               3 hours
  Prerequisite: PHYS 122, PHYS 222
  Corequisite: MATH 282
  Special relativity and quantum theory applied to atoms, molecules,
solids, nuclei and elementary particles. (Offered periodically)

PHYS 322  Classical Mechanics          3 hours
  Prerequisite: PHYS 122, 222
  Corequisite: MATH 282
  The Newtonian dynamics of particles and rigid bodies; central forces,
harmonic motion, many particle systems, and an introduction to the
formulism of Lagrange and Hamilton. (Offered periodically)

PHYS 331  Thermodynamics                3 hours
  Prerequisite: PHYS 122, 222
  The laws and application of thermodynamics, kinetic theory, trans-
port theory and statistical mechanics. (Offered periodically)

PHYS 351  Electromagnetic Fields       3 hours
  Prerequisite: MATH 283
  Electric and magnetic fields in the presence of matter, scalar, and
vector potentials, multipole expansions, Poisson's and LaPlace's equa-
tions, and an introduction to Maxwell's equations. (Offered periодi-
cally)

PHYS 352  Electromagnetic Radiation     3 hours
  Prerequisite: PHYS 351
  Maxwell's equations and electromagnetic waves; plane waves in
infinite media, reflection and refraction, guided waves, and multipole
radiation. (Offered periodically)

PHYS 411  Quantum Mechanics             3 hours
  Prerequisite: PHYS 311; MATH 283
  The Schrödinger equation, operators, angular momentum, pertur-
bation theory, scattering theory, and many particle systems. Techniques
from the theory of partial differential equations and linear algebra will be
introduced as needed. THIS COURSE MEETS THE UPPER DIVISION WRITING
COMPONENT FOR SENIOR YEAR ENGLISH. (Offered periodically)

PHYS 412  Advanced Modern Physics       3 hours
  Prerequisite: PHYS 411
  Applications of quantum mechanics to atoms, molecules, solids,
nuclei and elementary particles. (Offered periodically)

PHYS 491  Selected Topics               1-3 hours
  Prerequisite: Approval of department chair
  Study in areas of interest beyond those listed in the bulletin. May
include lectures, lab or readings under the direction of staff member.
Content and methods of study to be arranged prior to registration. May
be repeated for a total of 3 credits.