

# PHYSICS: PHYSICS SECONDARY CERTIFICATION CONCENTRATION, BACHELOR OF SCIENCE

## Expected Student Outcomes

Upon successful completion of the physics major, students will be able to:

- Think critically and logically and use the scientific method in their future investigations.
- Understand and apply knowledge of various subfields of physics at the undergraduate level and make a successful transition to technical fields, including engineering, teaching, business, and graduate studies.
- Effectively communicate their results orally and in writing.
- Learn independently, locate and use appropriate sources of technical material and make use of modern scientific and computational tools.

## Outcomes Assessment Activities

The Physics Program faculty will assess the skills, capacities, and knowledge of its majors as follows:

- The student must complete a senior research project including a formal presentation of results both in writing and orally to at least two members of the physics faculty (except for those in the teaching emphasis areas).
- The student must take the Physics Major Field Achievement Test offered by The Educational Testing Services (ETS) or another departmentally approved exam covering the sub-fields in physics at some point during his/her senior year (except for those in the teaching emphasis areas).
- By maintaining a portfolio for each student which contains college grades, records of special skills acquired, senior research project results, Field Achievement Test results and a record of co-curricular activities. The portfolio will remain on file in the department and will be added to as additional information is obtained from student or employer.

The program faculty believes that improvement in the skills, capacities, and knowledge of its minors can be assessed through required course work. The course grade will be a measure of the student's grasp of the basics in each discipline.

## Specific Program Requirements

- Students graduating with a BS in physics must have at least a 2.000 grade-point average in physics courses and no more than four credits in physics with grades of D.
- Students graduating with a minor in physics must have at least a 2.000 grade-point average in physics.
- A 2.500 grade-point average in the major area is required for admission to the teacher education program.
- At least 12 physics credits applied to the major (seven for minor) must be earned at CSU Pueblo with a C or better average.

- Students must have earned a C or better grade in lower-division prerequisite courses before being admitted to upper-division courses in physics.
- In all but the teaching concentration areas, students must demonstrate knowledge of computer programming.
- In all but the teaching concentration areas, majors are required to take the senior research course, in which students become involved in a theoretical or experimental research problem relating to physics under the supervision of a department faculty member.
- A fundamental understanding of chemistry and its lab techniques is required of all majors.

Course	Title	Credits
<b>PHYS Courses</b>		
PHYS 221 & 221L	GENERAL PHYSICS I and GENERAL PHYSICS I LAB	5
PHYS 222 & 222L	GENERAL PHYSICS II and GENERAL PHYSICS II LAB	5
PHYS 301	ANALYTICAL AND ORBITAL MECHANICS	4
PHYS 321	THERMODYNAMICS	3
PHYS 322	ADVANCED LABORATORY - THERMO	1
PHYS 323 & 323L	GENERAL PHYSICS III and GENERAL PHYSICS III LAB	5
PHYS 341	OPTICS	3
PHYS 342	ADVANCED LABORATORY-OPTICS	1
PHYS 431	ELECTRICITY AND MAGNETISM	4
PHYS 432	ADVANCED LABORATORY-ELECTRICITY AND MAGNETISM	1
PHYS 441	QUANTUM MECHANICS	4
PHYS 480	PRACTICUM IN LABORATORY INSTRUCTION	1
PHYS 492	RESEARCH	1
PHYS 493	SEMINAR	1
PHYS 499	THESIS RESEARCH	1
<b>Other Required Courses</b>		
CHEM 121 & 121L	GENERAL CHEMISTRY I and GENERAL CHEMISTRY LAB I	5
CHEM 122 & 122L	GENERAL CHEMISTRY II and GENERAL CHEMISTRY LAB II	5
MATH 242 or EN 103	INTRODUCTION TO COMPUTATION PROBLEM SOLVING FOR ENGINEERS	3-4
MATH 126	CALCULUS AND ANALYTIC GEOMETRY I	5
MATH 207	MATRIX AND VECTOR ALGEBRA WITH APPLICATIONS	3
MATH 224	CALCULUS AND ANALYTIC GEOMETRY II	5
MATH 325	INTERMEDIATE CALCULUS	4
MATH 337	DIFFERENTIAL EQUATIONS I	3
MATH 338	DIFFERENTIAL EQUATIONS II	3
<b>Approved Math Elective</b>		
Select 3-4 credits		3-4
<b>General Education</b>		
Select 24 credits		24
<b>Electives</b>		
Select 15-17 credits		15-17
<b>Total Credits</b>		<b>118-122</b>

## Specific Concentration Requirements

Course	Title	Credits
<b>PHYS Courses</b>		
PHYS 110	ASTRONOMY	3
PHYS 140 & 140L	LIGHT, ENERGY, & THE ATOM and LIGHT, ENERGY AND THE ATOM LAB	4
PHYS 221 & 221L	GENERAL PHYSICS I and GENERAL PHYSICS I LAB	5
PHYS 222 & 222L	GENERAL PHYSICS II and GENERAL PHYSICS II LAB	5
PHYS 321 & PHYS 322	THERMODYNAMICS and ADVANCED LABORATORY - THERMO	4
PHYS 323 & 323L	GENERAL PHYSICS III and GENERAL PHYSICS III LAB	5
PHYS 341 & PHYS 342	OPTICS and ADVANCED LABORATORY-OPTICS	4
PHYS 480	PRACTICUM IN LABORATORY INSTRUCTION	1
<b>Other Required Courses</b>		
BIOL 100 & 100L	PRINCIPLES OF BIOLOGY and PRINCIPLES OF BIOLOGY LAB	4
BIOL 121 & 121L	ENVIRONMENTAL CONSERVATION and ENVIRONMENTAL CONSERVATION LAB	4
CHEM 121 & 121L	GENERAL CHEMISTRY I and GENERAL CHEMISTRY LAB I	5
CHEM 122 & 122L	GENERAL CHEMISTRY II and GENERAL CHEMISTRY LAB II	5
ED 444	TEACHING SECONDARY SCIENCE	4
GEOL 101 & 101L	EARTH SCIENCE and EARTH SCIENCE LAB	4
MATH 126	CALCULUS AND ANALYTIC GEOMETRY I	5
MATH 224	CALCULUS AND ANALYTIC GEOMETRY II	5
<b>General Education</b>		
<b>Education Minor Requirements</b>		<b>33</b>
Select 21 credits		21
Total Credits		121

ED 488 or ED 489	STUDENT TEACHING SECONDARY STUDENT TEACHING K-12	12
Total Credits <sup>3</sup>		37-40

- <sup>1</sup> Music students may take PSYC 151 HUMAN DEVELOPMENT (3.0 c.h.) or PSYC 251 CHILDHOOD AND ADOLESCENCE (3.0 c.h.).
- <sup>2</sup> Music Education students may complete MUS 103 MUSIC AND COMPUTER TECHNOLOGY I (1.00 c.h.) and MUS 306 TECHNOLOGY FOR MUSIC EDUCATORS (2.00 c.h.) for ED 280 EDUCATIONAL MEDIA AND TECHNOLOGY (3.00 c.h.).
- <sup>3</sup> English/Language Arts student must also complete RDG 355 LINGUISTICS FOR EDUCATORS (3.0 c.h.)
- <sup>4</sup> Physical Education students may complete EPER 465 ADAPTED PHYSICAL EDUCATION (3.0 c.h.) or ED 412 TEACHING DIVERSE LEARNERS (3.00 c.h.).
- <sup>5</sup> GPA of 2.6 required
- <sup>6</sup> English/Language Arts student must also complete ED 447 TEACHING ENGLISH IN SECONDARY SCHOOLS (4.00 c.h.)

## Specific Requirements for Secondary & K-12 Education/Minor

The student must complete an appropriate major and the following Education courses:

Course	Title	Credits
Select one of the following:		
PSYC 151 or PSYC 251 or PSYC 342	HUMAN DEVELOPMENT <sup>1</sup> CHILDHOOD AND ADOLESCENCE EDUCATIONAL PSYCHOLOGY	3
ED 202	FOUNDATIONS OF EDUCATION	3
ED 280	EDUCATIONAL MEDIA AND TECHNOLOGY <sup>2</sup>	3
ED 301	FRAMEWORKS OF TEACHING (Admission to Education is completed in this course)	4
RDG 435	CONTENT AREA LITERACY <sup>3,5</sup>	4
Special Methods in Education Areas (Prerequisites - Admission to Education) <sup>5,6</sup>		4
ED 412	TEACHING DIVERSE LEARNERS <sup>4,5</sup>	3
ED 485	CAPSTONE SEMINAR IN EDUCATION	1