

# PHYSICS, 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 complete physics courses in their program with grades of C or better.
- 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.
- Physics majors are expected to complete at CSU Pueblo all physics courses in their program numbered above PHYS 323. Minors are expected to complete at least 7 credit hours of upper division physics courses at CSU Pueblo.
- 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 (GT-SC1)  | 5              |
| PHYS 222 & 222L               | General Physics II and General Physics II Lab (GT-SC1)  | 5              |
| PHYS 301                      | Analytical & 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 & 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 (GT-SC2) and General Chemistry Lab I (GT-SC1)   | 5              |
| CHEM 122 & 122L               | General Chemistry II (GT-SC2) and General Chemistry Lab II (GT-SC1)   | 5              |
| MATH 242                      | Introduction to Computation (The higher level and Python language of Math 242 is needed to increase the computational skill of majors and graduates.) | 4              |
| MATH 126                      | Calculus & Analytic Geometry I (GT-MA1)   | 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 16-17 credits          |   | 16-17          |
| <b>Total Credits</b>          |   | <b>120-122</b> |

## Planning Sheet

Disclaimer: The Planning Sheet is designed as a guide for student's planning their course selections. The information on this page provides

only a suggested schedule. Actual course selections should be made with the advice and consent of an academic advisor. While accurately portraying the information contained in the college catalog, this form is not considered a legal substitute for that document. Students should become familiar with the catalog in effect at the time in which they entered the institution.

| Course   | Title   | Credits      |
|--|---|--------------|
| <b>Year 1</b>  |   |              |
| <b>Fall</b>  |   |              |
| CHEM 121 & 121L  | General Chemistry I (GT-SC2) and General Chemistry Lab I (GT-SC1) | 5            |
| ENG 101  | Rhetoric & Writing I (GT-CO1)                                     | 3            |
| MATH 126   | Calculus & Analytic Geometry I (GT-MA1)                           | 5            |
| General Education  |   | 3            |
| <b>Credits</b>   |   | <b>16</b>    |
| <b>Spring</b>  |   |              |
| ENG 102  | Rhetoric & Writing II (GT-CO2)                                    | 3            |
| MATH 207   | Matrix and Vector Algebra with Applications                       | 3            |
| MATH 224   | Calculus and Analytic Geometry II                                 | 5            |
| PHYS 221 & 221L  | General Physics I and General Physics I Lab (GT-SC1)              | 5            |
| <b>Credits</b>   |   | <b>16</b>    |
| <b>Year 2</b>  |   |              |
| <b>Fall</b>  |   |              |
| MATH 242 or EN 103   | Introduction to Computation or Problem Solving for Engineers      | 4            |
| MATH 325   | Intermediate Calculus   | 4            |
| PHYS 222 & 222L  | General Physics II and General Physics II Lab (GT-SC1)            | 5            |
| General Education  |   | 3            |
| <b>Credits</b>   |   | <b>16</b>    |
| <b>Spring</b>  |   |              |
| CHEM 121 & 121L  | General Chemistry I (GT-SC2) and General Chemistry Lab I (GT-SC1) | 5            |
| MATH 337   | Differential Equations I  | 3            |
| PHYS 323 & 323L  | General Physics III and General Physics III Lab                   | 5            |
| General Education  |   | 3            |
| <b>Credits</b>   |   | <b>16</b>    |
| <b>Year 3</b>  |   |              |
| <b>Fall</b>  |   |              |
| MATH 338   | Differential Equations II   | 3            |
| PHYS 341   | Optics  | 3            |
| PHYS 342   | Advanced Laboratory-Optics  | 1            |
| General Education  |   | 6            |
| Elective   |   | 3            |
| <b>Credits</b>   |   | <b>16</b>    |
| <b>Spring</b>  |   |              |
| PHYS 301   | Analytical & Orbital Mechanics                                    | 4            |
| PHYS 321   | Thermodynamics  | 3            |
| PHYS 322   | Advanced Laboratory - Thermo                                      | 1            |
| PHYS 492   | Research  | 1            |
| General Education  |   | 3            |
| Elective   |   | 1-2          |
| <b>Credits</b>   |   | <b>13-14</b> |
| <b>Year 4</b>  |   |              |
| <b>Fall</b>  |   |              |
| PHYS 431   | Electricity & Magnetism   | 4            |
| PHYS 432   | Advanced Laboratory-Electricity and Magnetism                     | 1            |
| PHYS 480   | Practicum in Laboratory Instruction                               | 1            |
| Elective <sup>3 credits must be one of the following: MATH 307, MATH 356, or MATH 425.</sup> |   | 9-10         |
| <b>Credits</b>   |   | <b>15-16</b> |

| <b>Spring</b>        |                   |                |
|----------------------|-------------------|----------------|
| PHYS 441             | Quantum Mechanics | 4              |
| PHYS 493             | Seminar           | 1              |
| PHYS 499             | Thesis Research   | 1              |
| Elective             |                   | 6              |
| <b>Credits</b>       |                   | <b>12</b>      |
| <b>Total Credits</b> |                   | <b>120-122</b> |