

**Physics Department, TCNJ  
Learning Outcomes Map**

| Course #                          | Course Title                    | General Learning Outcomes       |                      |                        |                    |                       |                          |                       | Program Learning Outcomes                   |  |  |  |   |                                    |   | Outcomes for Secondary Education Majors                          |  |
|-----------------------------------|---------------------------------|---------------------------------|----------------------|------------------------|--------------------|-----------------------|--------------------------|-----------------------|---|--|--|--|---|------------------------------------|---|--|--|
|                                   |                                 | Critical analysis and reasoning | Scientific reasoning | Quantitative reasoning | Oral communication | Written communication | Technological competence | Information reasoning | Foundation of knowledge - classical Physics | Foundation of knowledge - modern Physics | Modeling, mathematical & computing skills to solve scientific and technical problems | Experimental skills to solve scientific and technical problems | Ability to provide technical expertise on complex societal issues | Experience in Independent Research | Skills in communicating technical knowledge | Acquisition of modern pedagogical methods for physics classrooms | Proficient application of physics content and pedagogy as instructor |
| <b>Courses for Non-majors</b>     |                                 |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 120                           | INTRODUCTION TO GEOLOGY         |                                 | X                    | X                      |                    | X                     | X                        | X                     |   |  | X  | X  | X   |                                    |   |  |  |
| PHY 121                           | PRINCIPLES OF PHYSICS           | X                               | X                    | X                      | X                  |                       | X                        |                       | X   |  | X  | X  |   |                                    | X   |  |  |
| PHY 161                           | INTRODUCTION TO ASTRONOMY       | X                               | X                    | X                      |                    | X                     | X                        | X                     | X   | X  |  |  |   |                                    |   |  |  |
| PHY 171                           | INTRODUCTION TO METEOROLOGY     |                                 | X                    | X                      |                    | X                     | X                        | X                     |   |  | X  | X  | X   |                                    | X   |  |  |
| <b>Support Courses</b>            |                                 |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 103                           | PHYSICAL, EARTH & SPACE SCIENCE |                                 | X                    | X                      |                    |                       |                          | X                     | X   | X  |  | X  |   |                                    |   |  |  |
| <b>Core Courses</b>               |                                 |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 099                           | ORIENTATION TO PHYSICS          |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 201                           | GENERAL PHYSICS I               |                                 | X                    | X                      |                    |                       | X                        | X                     | X   |  |  | X  | X   |                                    | X   |  |  |
| PHY 202                           | GENERAL PHYSICS II              |                                 | X                    | X                      |                    |                       | X                        | X                     | X   |  |  | X  | X   |                                    | X   |  |  |
| PHY 306                           | MATHEMATICAL PHYSICS            | X                               | X                    | X                      |                    |                       |                          | X                     | X   |  | X  |  |   |                                    |   |  |  |
| PHY 321                           | MODERN PHYSICS                  |                                 | X                    | X                      |                    | X                     | X                        | X                     |   | X  |  | X  | X   |                                    | X   |  |  |
| PHY 356                           | THERMAL PHYSICS                 | X                               | X                    | X                      |                    |                       | X                        | X                     | X   | X  | X  |  |   |                                    |   |  |  |
| PHY 401                           | CLASSICAL MECHANICS             | X                               | X                    | X                      |                    | X                     | X                        | X                     | X   |  | X  |  |   | X                                  | X   |  |  |
| PHY 421                           | ELECTROMAGNETIC THEORY I        |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 451* or                       | ADVANCED EXPERIMENTAL PHYSICS   |                                 |                      | X                      | X                  | X                     |                          |                       |   |  | X  | X  |   | X                                  |   |  |  |
| PHY 493*                          | INDEPENDENT RESEARCH II         |                                 | X                    | X                      |                    |                       | X                        | X                     |   | X  | X  |  |   | X                                  | X   |  |  |
| *CAPSTONE COURSES (must take one) |                                 |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| <b>Option Courses</b>             |                                 |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 220                           | ADVANCED GEOLOGY                | X                               | X                    |                        | X                  | X                     |                          | X                     |   |  |  | X  | X   |                                    | X   |  |  |
| PHY 261                           | ADVANCED GENERAL ASTRONOMY      | X                               | X                    | X                      |                    | X                     | X                        | X                     | X   | X  | X  |  |   |                                    | X   |  |  |
| PHY 299                           | RESEARCH FUNDAMENTALS           | X                               | X                    |                        |                    | X                     |                          | X                     | X   |  |  |  |   |                                    | X   |  |  |
| PHY 311                           | ANALOG & DIGITAL ELECTRONICS    |                                 | X                    | X                      |                    |                       | X                        |                       | X   | X  | X  | X  |   |                                    |   |  |  |
| PHY 316                           | BIOMEDICAL PHYSICS              |                                 | X                    | X                      |                    |                       | X                        | X                     |   | X  |  |  | X   |                                    | X   |  |  |
| PHY 345                           | THE PHYSICS OF CLOUDS & CLIMATE | X                               | X                    | X                      |                    | X                     | X                        | X                     |   |  | X  |  | X   |                                    | X   |  |  |

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|   |                                       | Critical analysis and reasoning | Scientific reasoning | Quantitative reasoning | Oral communication | Written communication | Technological competence | Information reasoning | Foundation of knowledge - classical Physics | Foundation of knowledge - modern Physics | Modeling, mathematical & computing skills to solve scientific and technical problems | Experimental skills to solve scientific and technical problems | Ability to provide technical expertise on complex societal issues | Experience in Independent Research | Skills in communicating technical knowledge | Acquisition of modern pedagogical methods for physics classrooms | Proficient application of physics content and pedagogy as instructor |
| PHY 370                                       | TOPICS IN PHYSICS                     | X                               | X                    | X                      | X                  | X                     |                          | X                     | X   | X  |  |  |   | X                                  |   |  |  |
| PHY 371                                       | TOPICS IN PHYSICS (writing intensive) | X                               | X                    | X                      |                    | X                     | X                        | X                     |   | X  |  |  | X   | X                                  |   |  |  |
| PHY 391                                       | INDEPENDENT STUDY IN PHYSICS          | X                               | X                    | X                      | X                  | X                     | (X)                      | (X)                   | (X)   | (X)                                      |  | (X)  | (X)   | (X)                                |   |  |  |
| PHY 393                                       | INDEPENDENT RESEARCH I                | X                               | X                    | X                      | X                  | (X)                   | (X)                      | X                     | X   | (X)                                      | (X)  | (X)  | X   | X                                  |   |  |  |
| PHY 411                                       | ELECTROMAGNETIC WAVES & OPTICS        |                                 | X                    | X                      | X                  | X                     | X                        | X                     | X   |  | X  | X  |   | X                                  |   |  |  |
| PHY 413                                       | GENERAL RELATIVITY & COSMOLOGY        | X                               | X                    | X                      |                    | X                     |                          | X                     | X   | X  |  |  |   |                                    |   |  |  |
| PHY 422                                       | ELECTROMAGNETIC THEORY II             |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 426                                       | PARTICLE AND NUCLEAR PHYSICS          | X                               | X                    | X                      | X                  | X                     |                          | X                     |   | X  | X  | X  |   | X                                  |   |  |  |
| PHY 431                                       | QUANTUM MECHANICS                     |                                 | X                    | X                      |                    |                       | X                        | X                     |   | X  | X  |  |   | X                                  |   |  |  |
| PHY 436                                       | CONDENSED MATTER                      |                                 | X                    | X                      | X                  |                       | X                        | X                     |   | X  | X  |  | X   | X                                  |   |  |  |
| PHY 466                                       | ASTROPHYSICS                          | X                               | X                    | X                      |                    | X                     |                          | X                     | X   | X  |  |  |   |                                    |   |  |  |
| PHY 493                                       | INDEPENDENT RESEARCH II               | X                               | X                    | X                      | X                  | X                     | X                        | X                     | X   | X  | (X)  | (X)  | X   | X                                  |   |  |  |
| <b>Secondary Education Courses in Physics</b> |                                       |                                 |                      |                        |                    |                       |                          |                       |   |  |  |  |   |                                    |   |  |  |
| PHY 390                                       | METHODS OF TEACHING SCIENCE           | X                               | X                    |                        | X                  | X                     | X                        | X                     |   |  |  |  |   | X                                  | X   | X  |  |
| PHY 490                                       | STUDENT TEACHING in PHYSICS           | X                               | X                    | X                      | X                  | X                     | X                        | X                     | X   |  |  | X  | X   | X                                  | X   | X  |  |