B.A. in Physics

(32 credits required for graduation with a minimum cumulative GPA of 2.00)

NOTE: This guide is not meant to replace the degree audit; it is subject to change and represents actions approved by Faculty to date. Students are encouraged to run their degree audit at the end of each term of enrollment. Please refer often to the *2018-2019 Online Catalog & Student Handbook http://catalog.berea.edu/en/current/catalog),* which will be updated with the most current information.

GENERAL EDUCATION PROGRAM

No single transfer course can meet more than one General Education requirement.

Core Courses

(Developmental math courses may be waived on basis of test scores.)
MAT 010 Pre-Algebra
MAT 011 Elementary Algebra
MAT 012 Elementary Algebra II

GSTR 110 Writing Seminar I: Critical Thinking in the Liberal Arts *(Transfer students may waive if College Composition was taken as a degree-seeking student at another college and earned a grade of B or higher.)*
GSTR 210 Writing Seminar II: Identity and Diversity in the U.S.
GSTR 310 Understandings of Christianity
GSTR 410 Seminar-Contemporary Global Issues

Scientific Knowledge and Inquiry

GSTR 332 Scientific Origins **OR**
Two (2) approved science courses, from two different disciplines, one of which must be an approved lab course. The following courses have been approved to meet this requirement: ANR 110, BIO 100, 101, 110, CHM 113, 131, PHY 111, 127, 221

Wellness & Fitness

WELL 101 Principles of Wellness I
WELL 102 Principles of Wellness II
Two (2) ¼-credit HHP activity courses *(HHP 200 will satisfy both the SWIM requirement and one of the activity course requirements)*

Practical Reasoning (PR &PRQ)

Two (2) courses, at least one firmly grounded in math or statistics (PRQ); the other can be an approved practical reasoning (PR) course or another PRQ course.

Perspectives (Six areas required)

One (1) course in **each** of the six areas is required. Individual courses may be approved to satisfy more than one perspective, but no single course may satisfy more than two perspective areas.
1) Arts
2) Social Science
3) Western History
4) Religion
5) African American/Appalachian/Women
6) International (choose one option):
   A) Two (2) courses in the same non-English language, one of which may be waived through testing; **OR**
   B) Two (2) world culture courses, one of which must be grounded in a non-western culture

Active Learning Experience

An approved experience, taken for credit or non-credit (e.g. internships, undergraduate research experiences).

MAJOR REQUIREMENTS

A minimum GPA of 2.0 in the major is required for graduation.

Core Courses

PHY 221 Intro Physics I w/Calculus
PHY 222 Intro Physics II w/Calculus
PHY 320 Modern Physics
PHY 365 Thermal Physics

Theory Courses

PHY 460 Electromagnetic Theory
PHY 481 Classical Mechanics

Required Advanced Laboratory

PHY 341 Advanced General Laboratory (1/2)

Capstone Course (one of the following)

PHY 492 Physics Seminar
PHY 495 Internship
UGR 010 or 020 Undergraduate Research

Distribution Courses (four total credits)

Two (2) course credits from departmental offerings, at least one at or above the 300-level. Two (2) additional credits from one of the following areas of focus:

Applied Physics

MAT 312 Operations Research
MAT 347 Differential Equations
PHY 321 Modern Physics II
PHY 335 Optics
PHY 485 Materials Physics
TAD 460 Digital Electronics

Chemical Physics

CHM 311 Analytical Chemistry
CHM 361 Thermochemistry
CHM 362 Quantum Chemistry
CHM 371 Advanced Lab – Spectroscopy (1/2)
CHM 470 Advanced Lab – Nuclear Magnetic Resonance (1/2)

Computational Physics

MAT 214 Linear Algebra
CSC 226 Software Design & Implementation
CSC 236 Data Structures
CSC/MAT 433 Numerical Analysis

Theoretical Physics

PHY 482 Quantum Physics
MAT 437 Differential Equations

Required Collateral Courses (count outside the major)

MAT 135 Calculus I
MAT 225 Calculus II
MAT 330 Calculus III

ELECTIVES

Twenty (20) credits outside the major

Exploring the Major Guidelines: Students expressing an interest in Physics as a major will be placed in the introductory Physics courses in their first year, depending on the students' mathematics preparation. Students should follow either: MAT 115 or 125 with PHY 127/128, **OR** MAT 135 with PHY 221/222, as described in Course Sequencing in the Physics Major description in the *Catalog & Student Handbook*.

Admission to the Major Guidelines: Students should earn a grade of C or higher in PHY 221, 222, and MAT 135 (or waiver) in order to be admitted into the Physics major. The Program recommends strongly that students who are interested in majoring in Physics talk with one of the Program's faculty members as early as possible.

Learning Goal 1: Develop an understanding of and appreciation for physics as a discipline
Learning Outcome 1.1: Demonstrate working knowledge of fundamental principles, theories, and problems in classical mechanics, special relativity, thermal physics, electromagnetism, and quantum mechanics.
Learning Outcome 1.2: Read, analyze, and summarize primary sources in physics, astronomy, and related disciplines.

Learning Goal 2: Recognize the value of critical thinking and quantitative problem solving skills in physics.
Learning Outcome 2.1: Analyze a problem to identify key physical principles, construct a suitable mathematical model, and formulate a solution.
Learning Outcome 2.2: Apply appropriate analytical and computational techniques to model physical systems, including the mathematics of differential and integral calculus, vector calculus, probability and statistics, linear algebra, and differential equations.
Learning Outcome 2.3: Employ physical intuition to answer conceptual questions, make order-of-magnitude approximations, and recognize whether or not the result of a calculation makes physical sense.

Learning Goal 3: Understand the importance of experimentation in physics.
Learning Outcome 3.1: Demonstrate proficiency in the observation, analysis, and interpretation of experimental data, including the role that uncertainty plays in interpreting experimental results.
Learning Outcome 3.2: Design, construct, and carry out an experimental, computational, or theoretical research project and report on the results through both written and oral communication.
Learning Outcome 3.3: Recognize and articulate the importance of professional and ethical conduct in scientific research.

Learning Goal 4: Appreciate the role of scientific discovery within the context of a liberal arts education, with particular focus on discoveries and developments in physics.
Learning Outcome 4.1: Identify significant historical developments in physics and discuss their impact on the broader society.
Learning Outcome 4.2: Identify and articulate connections between physics and other disciplines, and participate in opportunities for interdisciplinary study.

Learning Goal 5: Connect physics to real world experience.
Learning Outcome 5.1: Participate in a significant research or internship experience.
Learning Outcome 5.2: Demonstrate the ability to communicate the concepts and principles of physics and engineering to a wider audience with precision and clarity.

For students enrolled in 3/2 Dual Degree Engineering Science program:

Learning Goal 6: Upon completion of the Dual Degree Program, students will be academically prepared to meet the professional requirements of an accredited baccalaureate engineering program.
Learning Outcome 6.1: Successfully transfer to and graduate from an accredited engineering program.
Learning Outcome 6.2: Apply knowledge and skills from physics, mathematics, and related disciplines to professional practice as an engineer.