



## PHYSICS MINOR

Contact: Laura Stumpe

Email: [laura.stumpe@wcmo.edu](mailto:laura.stumpe@wcmo.edu)

You can find the course descriptions for all courses required for this minor by clicking on the following links:

- [Astronomy Course Descriptions](#)
- [Chemistry Course Descriptions](#)
- [Physics Course Descriptions](#)

ACADEMIC REQUIREMENTS SUMMARY SHEET

ACADEMIC YEAR 2022-2023

---

Student's Last Name

First Name

Middle Initial

---

Advisor

Date Minor Declared

Course #	Title of Course	Hours Required	Semester Completed	Grade
<b>Required Courses</b>				
PHY 201	Physics I	4		
PHY 212	Physics II	4		
PHY 223	Physics III	3		
<b>Choose two of the following courses (7-8 hrs)</b>				
AST 211	Astronomy	3		
CHM 424/425	Physical Chemistry I	4		
PHY 314	Thermodynamics	4		
PHY 324	Light	4		
PHY 325	Electronics	4		
PHY 415	Introduction to Theoretical Physics I	4		
PHY 416	Introduction to Theoretical Physics II	4		
<b>TOTAL HOURS FOR MINOR</b>		<b>18-19 hrs</b>		

If any substitutions or waivers of requirements are allowed, please list below and initial.

---

---

## AST – Astronomy

**AST 211 Astronomy** (3 hrs.) An introduction to astronomy, including a study of the solar system, stellar populations, galaxies, the structure of the universe and theories of the origin of stars, galaxies and the solar system. An occasional evening laboratory is included. Prerequisites: MAT 111 or one year of high school algebra and one year of high school geometry.

## CHM – Chemistry

**CHM 105 Introduction to Chemistry** (3 hrs.) A survey course intended for non-science majors. Chemical phenomena, methodology, and theory are presented in the context of public policy issues such as air and water quality, the ozone layer, global warming, acid rain, and energy sources.

**CHM 106 Introduction to Chemistry Laboratory** (1 hr.) Laboratory experiences are provided that are relevant to the science and technology issues discussed in CHM 105. Meets three hours per week. Experimentation and data collection lead to an understanding of the scientific method and of the role that chemistry plays in addressing societal issues.

**CHM 114 General Chemistry I** (3 hrs.) A study of the fundamental principles and theories of chemistry with emphasis on stoichiometry, atomic theory, and bonding. This course is offered in every fall semester.

**CHM 115 General Chemistry I Laboratory** (1 hr.) Laboratory to accompany CHM 114. Meets three hours per week.

**CHM 124 General Chemistry II** (3 hrs.) A continuation of CHM 114 with emphasis on equilibrium, electrochemistry, kinetics, and thermodynamics. This course is offered every spring semester.

**CHM 125 General Chemistry II Laboratory** (1 hr.) Laboratory to accompany CHM 124. Meets three hours per week.

**CHM 304 Inorganic Chemistry** (3 hrs.) A survey of inorganic chemistry at the intermediate level. Emphasis is on descriptive chemistry with discussion also of atomic and molecular structure, bonding theory, coordination chemistry, and energy changes in inorganic reactions. Prerequisites: CHM 124/125.

**CHM 314 Organic Chemistry I** (3 hrs.) A systematic study of the compounds of carbon with emphasis on the principles of synthesis, analysis, and reaction mechanisms of organic functional groups. This course is offered every fall semester. Prerequisites: CHM 124/125.

**CHM 315 Organic Chemistry I Laboratory** (1 hr.) Laboratory to accompany CHM 314. A study of the techniques of synthesis and analysis of organic compounds. Meets three hours per week. Prerequisites: CHM 124/125.

**CHM 324 Organic Chemistry II** (3 hrs.) A continuation of CHM 314. This course is offered every spring semester.

**CHM 325 Organic Chemistry II Laboratory** (1 hr.) Laboratory to accompany CHM 324. Meets three hours per week.

**CHM 334 Analytical Chemistry I** (3 hrs.) A study of the principles and methods of quantitative analysis. Prerequisites: CHM 124/125.

**CHM 335 Analytical Chemistry I Laboratory** (1 hr.) Laboratory to accompany CHM 334. Gravimetric, volumetric and simple instrumental methods are studied. Meets three hours per week. Prerequisites: CHM 124/125.

**CHM 344 Analytical Chemistry II** (2 hrs.) Introduction to instrumental methods of analysis with emphasis on the principles of measurement and instrumentation. Prerequisites: CHM 334/335.

**CHM 345 Analytical Chemistry II Laboratory** (2 hrs.) Laboratory to accompany CHM 344. Methods may include polarography, spectrophotometry, chromatography, potentiometric titrations, and amperometric and conductometric determinations. Meets six hours per week.

**CHM 404 Biophysical Chemistry** (3 hrs.) Introduction to physical chemistry with special emphasis on biological applications. Topics to be discussed include thermodynamics, chemical and physical equilibria, and kinetics (especially enzyme kinetics). Designed for those students who would otherwise not be exposed to physical chemistry. Prerequisites: CHM 124/125, MAT 124.

**CHM 410 Advanced Topics in Chemistry** (3 hrs.) Special courses on various topics are offered under this listing. Past offerings include Medicinal Chemistry and Chemical Kinetics. May be repeated for credit with change of topic.

**CHM 422 Advanced Inorganic Chemistry** (3 hrs.) A study of the principles and theories of inorganic chemistry, emphasizing modern approaches to the field. Prerequisites: CHM 304, 324/325, MAT 224, and PHY 212, or permission of the instructor.

**CHM 424 Physical Chemistry I** (3 hrs.) Chemical thermodynamics and kinetics. Topics include properties of gases, laws of thermodynamics, free energy, chemical equilibrium, chemical kinetics, and rate laws. Additional topics may include chemical dynamic models, phase equilibrium, and electrochemistry. Prerequisites: CHM 124/125, MAT 214, and PHY 212 or PHY 213 or with permission of instructor.

**CHM 425 Physical Chemistry I Laboratory** (1 hr.) Laboratory to accompany CHM 424. Meets three hours per week. Prerequisites: CHM 324/325, CHM 344/345, MAT 224, PHY 212.

**CHM 434 Physical Chemistry II** (3 hrs.) Quantum and statistical mechanics. Topics include quantum mechanical theory, quantum mechanical models for motion, the structure of atoms and molecules, molecular spectroscopy, and statistical thermodynamics. Prerequisites: CHM 424.

**CHM 435 Physical Chemistry II Laboratory** (1 hr.) Laboratory to accompany CHM 434. Meets three hours per week.

## PHY – Physics

**PHY/EGR 101 Introduction to Engineering and Design** (3 hrs.) This course introduces students to the engineering profession. Emphasis is placed on engineering design, project management skills, software applications, teamwork, and communication. An engineering term project including a written technical report is required for this course. Offered every spring semester.

**PHY 105 Introduction to Physics** (3 hrs.) An introductory study of the foundations and concepts of modern physical theory. The course stresses the historical significance and philosophical implications of classical mechanics, the special and general theories of relativity and quantum theory. This course is intended for non-science majors. However, students who plan to enroll in PHY 201, but who have not taken high school physics, are encouraged to take this course first. Not open to students with credit in PHY 201. This course is typically offered once per academic year in the spring semester. Prerequisites: MAT 111 or one year of high school algebra.

**PHY 201 Physics I** (4 hrs.) A study of the science of physics covering topics in mechanics, gravitation and rudimentary quantum physics. Lecture, three hours; laboratory, three hours. This course is offered once per academic year in the Fall semester. Prerequisites: PHY 105 or one year of high school physics and previous or concurrent enrollment in MAT 124 or one year of high school calculus.

**PHY 202 Algebra-Based Physics I** (4 hrs.) Algebra-based Physics I is an introductory physics course which covers the topics of Newtonian mechanics, conservation laws, and fluid statics and dynamics. The course includes a laboratory. Prerequisite: MAT 111 or one year of high school Algebra.

**PHY 212 Physics II** (4 hrs.) A continuation of Physics I covering topics in electromagnetism, electric circuits, waves, optics, atomic physics, nuclear physics and particle physics. Lecture three hours; laboratory three hours. This course is offered once per academic year in the spring semester. Prerequisites: Completion of PHY 201 with a C- or better.

**PHY 213 Algebra-Based Physics II** (4 hrs.) Algebra-based Physics II is a continuation of Algebra-based Physics I and covers the topics of oscillatory motion, waves, electricity and magnetism, optics, and selected topics in modern physics. This course includes a laboratory. Prerequisite: C- or better in Algebra-based Physics I.

**PHY 223 Physics III** (3 hrs.) A continuation of Physics II covering topics that require a command of calculus and more abstract concepts than those presented in PHY 201 or 212. The course is a study of selected topics in relativity, quantum mechanics and modern physics (including elementary particles). This course is typically offered once per academic year in the fall semester. Prerequisites: PHY 212 and previous or concurrent enrollment in MAT 214.

**PHY/EGR 230 Engineering Mechanics & Statics** (3 hrs.) Statics is the study of rigid-body mechanics which deals with the equilibrium of bodies. Covered topics include the principles of statics, force systems, internal forces, structural analysis, friction, center of gravity, and moments of inertia. Prerequisites: MAT 224 and PHY 201 with a C- or better.

**PHY 314 Thermodynamics** (4 hrs.) Study of the general laws of thermodynamics, the kinetic theory of gases and statistical mechanics. Lecture three hours; laboratory three hours. Prerequisites: PHY 223 and MAT 224.

**PHY 315 Modern Physics** (4 hrs.) The course covers applications of quantum theory and relativity theory to atoms, molecules and subatomic particles. Lecture three hours; laboratory three hours. Prerequisites: PHY 223 and MAT 224.

**PHY 324 Light** (4 hrs.) A study of topics in geometrical and physical optics and in spectroscopy, including an examination of optical instruments and light sources such as lasers. Lecture three hours; laboratory three hours. This course is typically offered every other academic year in the spring semester and alternates with PHY 325. Prerequisites: PHY 223.

**PHY 325 Electronics** (4 hrs.) The theory of semiconductor devices and applications of these devices in circuits. The course emphasizes electronic instrumentation and experimental technique. Lecture three hours; laboratory three hours. This course typically is offered every other academic year during the spring semester and alternates with PHY 324. Prerequisites: PHY 212.

**PHY 328 Analog Circuits** (4 hrs.) We will investigate the theory and experimental procedures of modern electronic analog circuits. There are two main classes of electronics: analog and digital. Analog circuits, covered this semester, deals with electrical signals that can have a continuous range of values, while digital circuits, covered during the second semester of the circuits sequence, involves digital signals that can have only a small number of discrete values. Prerequisites: PHY 212 and MAT 214.

**PHY 398 Independent Study** (1-4 hrs.) On topics from the major areas of physics, chosen according to the background, requirements, or interests of the individual student. Course work will consist of readings, problem solving, laboratory research, practicums, reports or conferences, as appropriate.

**PHY 415 Introduction to Theoretical Physics I** (4 hrs.) Vector analysis is developed as a working tool and applied to problems in mechanics and electromagnetic theory. The topics covered include statics, kinematics and dynamics of particles and rigid bodies, moments of inertia and inertia tensors, work and energy, gravitational theory, oscillations and electric and magnetic fields in vacuo and in material substances. Four lectures per week. This course is offered as needed. Prerequisites: PHY 223, MAT 224 and previous or concurrent enrollment in MAT 312.

**PHY 416 Introduction to Theoretical Physics II** (4 hrs.) Vector analysis is developed as a working tool and applied to problems in electromagnetic theory and quantum mechanics. The topics covered include Maxwell's equations and time-dependent fields, energy and forces associated with these fields, wave propagation and the postulates of quantum mechanics, wave functions, expectation values and the quantization of angular momentum in atoms. Four lectures per week. This course is offered as needed. Prerequisites: PHY 223, MAT 224 and previous or concurrent enrollment in MAT 312.