PHYSICS & ASTRONOMY UNDERGRADUATE HANDBOOK

Handbook revision: 2024

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Purpose of this Document

The document is designed to help you, the undergraduate, guide your way through the undergraduate curriculum at WSU (Washington State University), and to help you graduate with the skills you need for your future career and academic aspirations. This booklet has information on prospective careers, semester-by-semester course pathways for every physics specialist degree, and a list of who to contact for help and guidance. This document does not replace the University Catalog. Where conflicts exist, the Catalog is to be taken as being correct.

Planning For Academic Success

An academic advisor is a student's personal connection with the university, its apparatus, rules, and regulations. The student and advisor share the responsibility for planning the best route to ensure the student's academic and career success. It is up to the student to see this plan through to its successful conclusion.

Responsibilities of the student

Your responsibilities include, but are not limited to:

- Meet with your advisor for a minimum of 30 minutes, at least once each semester before your enrollment time opens, to plan for the next semester. You should meet with all your advisors, including those in your major and minor degrees of study, and (if applicable) in the Honors College, athletic program, ROTC (Reserve Officer Training Corps), pre-health, and/or pre-law.
- Always know your current grade in all your classes. If you are going to fail a class or, worse, to go academically deficient, meet with your advisor as early as possible to discuss options. Practice "an ounce of prevention."
- Meet with each of your instructors and find out what is expected of you to be successful in your current semester's classes.
- Use the Student Information System website (my.wsu.edu) to:
    - view your account status,
    - sign up for classes using Schedule Surfer,
    - check your progress towards your degree using the Degree Requirements page.
- Obtain and use your WSU email account. Many faculty members ignore messages sent from non-WSU domains to prevent identity theft.
- Become familiar with the WSU graduation requirements, the requirements of the College of Arts & Science, the requirements of the Physics major, and the requirements of any degree option or minor degree program you are interested in.
- Build positive and supporting relationships with the people in the Dept of Physics and Astronomy, including your instructors, advisors, teaching assistants, fellow classmates, and support staff. We are all here to help each other. Take advantage of the opportunities provided by the Physics & Astronomy club, and the Webster 7th floor undergraduate physics study room.
- Seek help when needed. Provide help when asked.

Responsibilities of your academic advisor

Our responsibilities include the following list.

- To assist you, the student, in choosing courses appropriate to your academic and career goals
- To inform you of the rules and regulations governing the university, college, and department.
- To advise you how to act to comply with these regulations.
- Put you in touch with university offices and officials who can help you reach your academic and career goals.

Admission to the major

Students may be admitted to the major by making their intention known to their academic advisor. Recommended preparation:

1. have earned 30 or more credit hours, including Phys 201 or 205, and Math 171,
2. have a cumulative WSU GPA (Grade Point Average) above 2.0.

Scholarships

Scholarship deadline: January 31

Scholarships for physics undergraduates are available from the College of Arts & Sciences via an online application form: cas.wsu.edu.

Student learning outcomes of the Physics & Astronomy degree

The learning outcomes of the BS Physics degree program align with university-wide outcomes:

1. use scientific reasoning to form and test hypotheses (Critical and Creative Thinking)
2. think independently and question dogma by acquiring, reproducing, and assessing information from a variety of sources (Information Literacy)
3. recall and apply the important concepts in each of the four core areas of physics: mechanics, electricity and magnetism, modern and quantum physics, and thermal and statistical physics (Scientific Literacy)
4. design and conduct scientific experiments which test new ideas and theories (Quantitative Reasoning)
5. present concepts and results clearly, both orally and in writing (Communication)
6. be prepared for graduate study and/or careers in physics (Depth, Breadth, and Integration of Learning)

Important academic dates

The website of the Registrar, www.registrar.wsu.edu, lists the following dates for every semester. You should know when these occur, and make timely decisions based upon them. The dates listed below are approximate, and do not include the summer terms.

Week 01 - First day of instruction for the semester
Week 01 - Last day to add a course online
Week 05 - Deadline for dropping a course without record
Week 08 - Deadline to apply for an undergraduate degree
Week 08 - Midterm grade submission
Week 12 - Priority registration for the next semester
Week 13 - Deadline to withdraw from a course
Week 15 - Last day of instruction for the semester
Week 15 - Deadline for cancellation of enrollment
Week 16 - Commencement
Week 16 - Final examinations
Week 17 - Final grade submission deadline

Careers for Physicists

Physics is the most fundamental science in that laws of physics underlie all other physical sciences, including astronomy, chemistry, meteorology, oceanography, and geophysics. Physical theories also form the basis of all engineering and even the biological and medical sciences. Thus, training in physics can lead to a career in any of the sciences.

The physics curriculum is not designed to train people for specific jobs. It is designed to encourage students to become well-grounded in the basic theories and techniques of science and the mathematics necessary to be a physicist. When this is accomplished, there is usually no problem in finding a job. Although many, if not most, physicists go on to graduate school to earn master's or doctoral degrees, there are many good jobs available to a person with a B.S. in physics, either in industry or government. The range of career opportunities is too wide to enumerate. Some of the jobs listed may require some academic work beyond the bachelor's degree or on-the-job training or both.

Career resources are provided by many professional organizations:

American Institute of Physics – aip.org
American Physics Society – aps.org
American Astronomical Society - aas.org
Canadian Astronomical Society – cas.org
Astrobites – astrobites.org
Astrobetter – astrobetter.com
Chronicle for Higher Education – chronicle.com
Society of Physics Students – spsnational.org

International Astronomical Union – iau.org
LinkedIn – linkedin.com
Handshake – wsu.joinhandshake.com

Undergraduate Research

Students in the physics major are invited to participate in research and gain course credits via Phys 489/490 (Thesis) and Phys 499 (Special Projects). Students are encouraged to speak with faculty members, graduates, and senior undergraduates, and learn about what opportunities are available. Faculty within the Dept of Physics & Astronomy specialize in four major areas of research:

- Astrophysics - theoretical and experimental gravity wave physics, stellar and galactic evolution
- Matter under extreme conditions - high pressure effects on semiconductors and organic solids, reduced-gravity acoustics
- Materials and optical physics - ultrafast phenomena, interactions between photons and matter in nanostructures and biological materials, nonlinear optics
- Novel states of matter - theoretical and experimental quantum physics, cold quantum gases, many-body physics, chaos, and complexity

General Information

University Graduation Requirements pre fall 2012:

GER (General Education Requirements) Students who entered post-secondary education BEFORE fall 2012 are required to meet WSU General Education Requirements (GERs) and College of Sciences Additional Graduation Requirements (AGRs) to graduate.

Communication proficiency [W][C] - English 101 or 105 - 3cr
World Civilization [A] - GenEd 110/111 or History 120/121 - 6cr
Mathematics proficiency [N] - 4cr
Arts and Humanities [G][H] - 3cr
Social Sciences [S][K] - 3cr
Additional credits [G][H][S][K] - 3cr
Intercultural studies [I][G][K] - 3cr
Sciences lecture with lab [B][P][Q] - 10cr
American diversity [D] - 3cr
Tier III [T] - 3cr
University writing portfolio - milestone
Writing in the major [M] - 6cr
AGR: foreign language - milestone
AGR (Additional Graduation Requirements): [G][H][S][K][I] - 6cr
AGR: lecture with lab [B][P][Q] - 2cr

University Graduation Requirements post fall 2012:

UCORE (University Common Requirements) Students who entered post-secondary education AFTER fall 2012 are required to meet UCOREs and College of Arts and Sciences Additional Graduation Requirements (AGRs). Transfer students entering WSU in fall 2012 through summer 2013 will be required to satisfy the old GER system.

First-year Experience (required):

- Roots of contemporary issues [ROOT] - History 105 or 305 – 3cr

Foundational competencies (required):

- Quantitative reasoning [QUAN] - 3cr
- Written communication [WRTG] - 3cr
- Communication [COMM][WRTG] - 3cr

Inquiry: ways of knowing (required 6 of 7):

- Social sciences [SSCI] -3cr
- Humanities [HUM] - 3cr
- Creative and professional arts [ARTS] - 3cr
- Physical sciences [PSCI] - 3 or 4cr
- Biological sciences [BSCI] - 3 or 4cr
- Global cultural diversity [DIVR] - 3cr
- Equity and justice [EQJS] - 3cr

Integrative learning (required):

- Integrative capstone [CAPS] - 3cr

Other graduation requirements:

- University writing portfolio - milestone
- Writing in the major [M] - 6cr

College of Arts & Sciences additional graduation requirements (required):

- Foreign language
- Inquiry: ways of knowing – all 7
- Additional lab science [BSCI][PSCI] - 1cr

NOTE: Holding an Associate of Arts or Associate of Sciences degree does not automatically satisfy AGRs.

Foreign Language Requirement

Effective Fall 2011, students in the College of Arts and Sciences are required to demonstrate proficiency in four language skills (reading, writing, listening, and speaking) at a novice level (e.g., Spanish 102). Acceptable demonstrations of proficiency include:

- two years at the high school level (transcript required),
- two college semesters (transcript required) or two college quarters,
- residence abroad for two consecutive years during the last five (documentation required),
- study abroad for at least one year (documentation required),
- heritage speakers with at least one year of language studies at the high school level and who speak the language in the home (documentation required),
- STAMP test results (minimum score 2 in all three sections for European languages, minimum score 1 in all three sections for character-based languages).

Students may petition to substitute foreign language competency with an approved culture-related course based upon individual circumstances such as a learning disability, or for mature or returning students. The list of approved substitutions (April 2014) includes:

CATEGORY A: FOR L 101, 110, 120, 130, 410.
CATEGORY B: HIST 331, 335; PHIL 314, 315; ASIA/CHIN 111, 121, 131, 320; FREN 110, 120, 420, 430; GER 110; RUS 321; SPAN 110, 111, 120, 121, 420.

Upon approval, students must complete either TWO courses category A, or ONE course from each of category A and category B. All courses are taught in English.

The petition form, "WSU University and College Requirement Petition," is available from the University College office in Smith Center for Undergraduate Education (CUE) 519. You must follow the instructions on this form exactly.

Preparation for Graduate School in Physics

Students planning to enter graduate school in physics should take more physics and mathematics courses than the minimum requirements for graduation. Recommended additional courses include physics and math courses at the 400 and 500 level. Mastering the material in these courses should prepare a student for any of the most rigorous graduate schools in the country.

Preparation for Graduate School in Subjects other than Physics

A physics major is excellent preparation for graduate work in any of the physical and biological sciences, and engineering. Interdisciplinary fields, such as physical forensics, physical anthropology, and history of science, also include many physics majors. The problem-solving skills learned in the physics major are valuable in professional school, including the medical, business, and legal fields. Students interested in pursuing higher education in areas other than physics are encouraged to identify these areas early, and enroll in elective coursework, pursue a minor degree, a certificate program, or a course concentration.

Working for a year before entering graduate/professional school is common, and sometimes encouraged. Work experience helps clarify career and life goals, provides an intellectual break, and aids financially.

Preparation for Employment

Engineering firms, both large and small, employ physics graduates, often in jobs labeled "engineer," but in areas requiring a broad mindset. It is not necessary to take specialized courses for these jobs, because the companies usually will train you for the job they have in mind. Note, however, that without an advanced degree it is difficult to rise far in the field of research and development. Individuals with a bachelor's degree may well start at the level of a technician. Many working physicists return to school after a few years in the work force. Many working physicists self-identify as computational physicists.

Basic Requirements for a Major in Physics at WSU

Students must meet the graduation requirements of the university, college, and department they are enrolled in. A description of courses is given at the end of this Handbook.

Physics Courses
Phys 188 and 189 – First year seminar 1 and 2 – 2cr
Phys 201/211 and 202/212 – Physics 1 and 2 - 8cr
Phys 205 and 206 – Physics 1 and 2 Honors (recommended) - 10cr
Phys 303 and 304 – Modern 1 and 2 - 6cr
Phys 320 – Classical mechanics - 3cr
Phys 330 – Thermal physics - 3cr
Phys 341 and 342 – Electricity and magnetism 1 and 2 - 6cr
Phys 410 – Electronics lab - 4cr
Phys 415 [M] - Quantum lab - 3cr
Phys 450 – Quantum mechanics – 3cr
Phys 489 – Thesis proposal - 1cr
Phys 490 [M] - Thesis - 1cr

Math Courses
Math 171, 172 or 182, and 273 or 283 - Calculus 1, 2, and 3 - 10cr
Math 220 or 225 or 230 – Linear algebra - 2cr
Math 315 – Differential equations - 3cr

Chemistry Courses
Chem 105 [PSCI] and 106 - Chemistry 1 and 2 - 8cr

Computer Science Course (choose 1)
Cpt S 111 [QUAN] - Introduction to Computer Programming - 3cr
Cpt S 121 - Program Design and Development - 4cr

EE 221 - Numerical Computing for Engineers - 2cr
Math 300 - Mathematical Computing - 3cr

Technical Writing (choose 1)
Engl 301 [WRTG] - Writing and rhetorical conventions - 3cr
Com 400 [COMM] - Communicating science and technology - 3cr
Engl 402 or 403 [WRTG][M] - Technical writing - 3cr

Choose one option from Standard, Applied, Astrophysics, or Planetary Sciences:

Standard option
Choose 15 credits from Astr 3xx or 4xx, or Phys 3xx or 4xx.
Choose 6 credits from Astr, Chem, Math, or Phys; at least 3cr must be from the upper division.
Choose 6 credits of Math 3xx or 4xx.

Applied option
Choose 18cr from the College of Engineering (VCEA), in addition to Engr 120
Math 360 or 370; Phys 443

Astrophysics option
Astr 345, Astr 390, Astr 435, Astr 436
Choose 11 credits from Astr, Chem, Math, or Phys; at least 6cr must be from the upper division.
Choose 6 credits of Math 3xx or 4xx

Planetary Sciences option:
Choose 30cr from the School of the Environment (SOE)

Minor Degree Programs in Physics and Astronomy

Upper division physics and astronomy courses have lower division physics and math prerequisites that must be met, typically consisting of higher calculus and general physics. Students from outside the College of Sciences do not have to meet the College's Additional Graduation Requirements to obtain these minor degrees.

Requirements for Undergraduate Minor in Physics (20 credits)
The following courses are required (14 credit hours):
Phys 201/211 or 205 Physics 1
Phys 202/212 or 206 Physics 2
Phys 303 Modern Physics 1
Phys 304 Modern Physics 2

Choice of any two courses from the following (6 credit hours):
Phys 320 Mechanics
Phys 330 Thermal Physics

Phys 341 Electricity and Magnetism 1
Phys 342 Electricity and Magnetism 2
Phys 410 Electronics Laboratory
Phys 415 Quantum Lab
Phys 443 Optics
Phys 450 Quantum Mechanics
Phys 461 Atomic Physics
Phys 463 Solid State Physics
Phys 465 Nuclear Physics

Requirements for Undergraduate Minor in Astronomy (19 credits)

The following courses are required:
Math 273 Calculus 3
Phys 303 Modern Physics 1
Astr 345 Principles of Astronomy
Astr 435 Astrophysics 1 - Stellar Astrophysics
Astr 436 Astrophysics 2 - Extragalactic Astrophysics

At least two hours from the following:
Astr 390 The Night Sky
Phys 489 Thesis proposal
Phys 490 Thesis
Phys 499 Special Problems

Choice of three hours from the following:
Astr 135 Descriptive Astronomy
Astr 138 Planets and Planetary Systems
Hist 381 History of Science 1
SOE 103 Other Worlds: Comparative Planetology

Projected Course Offerings

Astr 135 Descriptive astronomy	Fall/spring
Astr 138 Planets & planetary systems	Fall/spring
Astr 345 Principles of astronomy	Fall
Astr 390 Night sky	Summer (subject to enrollment)
Astr 435 Astrophysics 1	Even-numbered spring
Astr 436 Astrophysics 2	Odd-numbered spring
Astr 450 Life and the universe	Spring
Phys 101/111 General physics 1	Fall/spring/summer
Phys 102/112 General physics 2	Fall/spring/summer
Phys 150 Physics and your world	Fall
Phys 188 First-Year Seminar 1	Fall

Phys 189 First-Year Seminar 2	Spring
Phys 201/211 Physics 1	Fall/spring/summer
Phys 202/212 Physics 2	Fall/spring/summer
Phys 205 Honors physics for sci/eng 1	Spring
Phys 206 Honors physics for sci/eng 2	Fall
Phys 303 Modern physics 1	Fall
Phys 304 Modern physics 2	Spring
Phys 320 Classical mechanics	Fall
Phys 322 Sound waves and music	Fall
Phys 330 Thermal physics	Spring
Phys 341 Electricity & magnetism 1	Fall
Phys 342 Electricity & magnetism 2	Spring
Phys 410 Electronics lab	Spring
Phys 415 Quantum lab	Spring
Phys 443 Optics	Fall
Phys 450 Quantum mechanics	Fall
Phys 455 Quantum technologies and computation	Even-numbered fall
Phys 461 Atomic	Odd-numbered spring
Phys 463 Solid state	Spring
Phys 465 Nuclear	Even-numbered spring
Phys 466 Biophysics	Spring (subject to enrollment)
Phys 481 Special topics	By arrangement
Phys 489 Thesis proposal	Spring
Phys 490 Thesis	Fall
Phys 499 Special topics	Fall/spring

Four-year plans

Physics - Standard Option (120-124 hours)

First year			
Fall		Spring	
Chem 105 [PSCI]	4	Chem 106	4
English 101 [WRTG]	3	History 105 [ROOT]	3
Math 171 Calc 1	4	Math 172 Calc 2	4
Phys 188 First year seminar	1	Physics 189 First year seminar	1
Social sciences [SSCI]	3	Phys 201/211 or 205	4-5
Second year			
Biological sciences [BSCI]	3	Humanities [HUM]	3
Math 220 or 225 or 230 Linear algebra	2	Math 315 Differential equations	3
Math 273 Calc 3	2	Phys 304 Modern 2	3
Phys 202/212 or 206	4-5	Phys 330 Thermal	3
Phys 303 Modern 1	3	Phys 410 Electronics lab	4
College foreign language requirement		University writing portfolio	
Third year			
Computing requirement	2-4	Technical writing [WRTG]	3
Diversity [DIVR]	3	Math elective	3
Math elective	3	Phys 342 Electricity and magnetism 2	3
Phys 320 Mechanics	3	Phys 415 [M] Quantum lab	3
Phys 341 Electricity and magnetism 1	3	Phys 489 Thesis proposal	1
		Standard option elective	3
Fourth year			
Equity [EQJS]	3	Capstone [CAPS]	3
Creative and professional arts [ARTS]	3	Standard option electives	9
Phys 450 Quantum mechanics	3	Technical elective	3
Phys 490 [M] Thesis	1		
Standard option elective	3		
Technical elective	3		

NOTES:

1. Computing requirement selected from CPTS 111, 121, 131, EE 221, and MATH 300.
2. 15 hours of Standard option electives from PHYSICS 3XX or 4XX, or ASTRONOM 3XX or 4XX.
3. Physics majors are recommended to enroll in the Honors sections of Intro Physics.
4. Technical electives (6cr) must include at least 3 hours at the upper division, and be chosen from ASTRONOM, CHEM, MATH, or PHYS.
5. A 4cr BSCI lecture plus lab may be required for a minor or second major.
6. The University Writing Portfolio must be completed shortly after earning 60 credits; transfer students are held to the same requirement.
7. Six hours of Math 3XX or 4XX are required.
8. Technical writing selected from English 301, 402/403, or COM 400.

Physics - Standard Option - Pre-calculus path (122-126 hours)

Students who enter and do not place into calculus in their first year will require 9 semesters to graduate.

First year			
Fall		Spring	
Chem 105 [PSCI]	4	Chem 106	4
English 101 [WRTG]	3	History 105 [ROOT]	3
Math 106 College algebra (as l/d elective)	3	Math 108 Trig	2
Phys 188 First year seminar	1	Phys 189 First year seminar 2	1
Arts [ARTS]	3	Humanities [HUM]	3
Second year			
Computing requirement	2-4	Biological science [BSCI]	3
Math 171 Calc 1	4	Diversity [DIVR]	3
Social sciences [SSCI]	3	Math 172 Calc 2	4
Equity [EQJS]	3	Phys 201/211 or 205	4-5
College foreign language requirement	0-4	Complete University Writing Portfolio	
Third year			
Math 220 or 225 or 230 Linear algebra	2	Math 315 Differential equations	3
Math 273 Calc 3	2	Phys 304 Modern 2	3
Math 360 Statistics (as math elective)	3	Phys 330 Thermal physics	3
Phys 202/212 or 206	4-5	Phys 410 Electronics lab	4
Phys 303	3	u/d elective	3
Fourth year			
Capstone [CAPS]	3	Phys 342 Electricity and magnetism 2	3
Phys 320 Mechanics	3	Phys 415 [M] Quantum lab	3
Phys 341 Electricity and magnetism	3	Phys 489 Thesis proposal	1
Standard option electives	6	Standard option electives	9
Fifth year			
Math elective	3		
Technical writing	3		
Phys 450 Quantum mechanics	3		
Phys 490 [M] Thesis	1		

NOTES:

1. Read the notes to the Standard Option.
2. Math 106 counts as 3 hours towards Astr/Chem/Math/Phys electives; the other 3 hours must come from the upper division.
3. To finish in 9 semesters, it is essential to enroll in Math 360 in the junior year, because Math 360 is the only upper division Math course not to have Math 315 as a prerequisite.

Physics - Astrophysics Option (120-124 hours)

First year			
Fall		Spring	
Chem 105 [PSCI] Chemistry 1	4	Chem 106 Chemistry 2	4
Math 171 Calc 1	3	History 105 [ROOT]	3
Phys 188 First year seminar 1	1	Math 172 Calc 2	4
English 101 [WRTG]	3	Phys 189 First year seminar 2	1
Social sciences [SSCI]	3	Phys 201/211 or 205 Physics 1	4-5
Second year			
Math 220 or 225 or 230 Linear algebra	2	Astro 390 Night sky	1
Math 273 Calc 3	2	Humanities [HUM]	3
Phys 202/212 or 206 Physics 2	4-5	Math 315 Differential equations	3
Phys 303 Modern 1	3	Phys 304 Modern 2	3
Biological sciences [BSCI]	3	Phys 330 Thermal physics	3
College foreign language requirement	0-4	Phys 410 Electronics lab	4
		Complete University Writing Portfolio	
Third year			
Astro 345 Principles	3	Astro 435 or 436 Astrophysics	3
Computing requirement	2-4	Technical writing [WRTG]	3
Math elective	3	Math elective	3
Phys 320 Mechanics	3	Phys 342 Electricity and magnetism 2	3
Phys 341 Electricity and magnetism 1	3	Phys 415 [M] Quantum lab	3
		Phys 489 Thesis proposal	1
Fourth year			
Equity and justice [EQJS]	3	Astro 435 or 436 Astrophysics	3
Creative and professional arts [ARTS]	3	Capstone [CAPS]	3
Phys 450 Quantum mechanics	3	Diversity [DIVR]	3
Phys 490 [M] Thesis	1	Technical electives	6
Technical electives	6		

NOTES:

1. Read the notes to the Standard Option.
2. The recommended prerequisite to Astronomy 345 is Phys 303.
3. Astronomy 435 is offered in even-numbered years, Astronomy 436 in odd-numbered years. They can be taken in any order.

Physics - Applied Option (120 hours)

The program of courses below is appropriate for students who wish to enter industry upon graduation.

First year			
Fall		Spring	
Chem 105 [PSCI] Chemistry 1	4	Chem 106 Chemistry 2	4
Diversity [DIVR]	3	Engr 120 Design	2
English 101 [WRTG]	3	History 105 [ROOT]	3
Math 171 Calc 1	4	Math 172 Calc 2	4
Phys 188 First year seminar	1	Phys 189 First year seminar 2	1
Second year			
Econ 101 [SSCI] Economics	3	Creative and professional arts [ARTS]	3
Equity and justice [EQJS]	3	Econ 102 [SSCI] Economics	3
Math 220 or 225 or 230 Linear algebra	2	Math 315 Differential equations	3
Math 273 Calc 3	2	Phys 202/212 or 206 Physics 2	4-5
Phys 201/211 or 205 Physics 1	4-5	Option elective	3
Option elective	3	Complete University Writing Portfolio	
College Foreign Language requirement	0-4		
Third year			
Phys 303 Modern 1	3	Biological sciences [BSCI]	3
Phys 320 Mechanics	3	Phys 304 Modern 2	3
Physics 341 Electricity and magnetism 1	3	Phys 330 Thermal physics	3
Stat 360 or 370 Statistics	3	Phys 342 Electricity and magnetism 2	3
Option elective	3	Phys 489 Thesis proposal	1
		Option elective	3
Fourth year			
Technical writing [WRTG]	3	Capstone [CAPS]	3
Humanities [HUM]	3	Diversity [DIVR]	3
Phys 443 Optics	3	Phys 415 [M] Quantum lab	3
Phys 450 Quantum mechanics	3	Physics elective	3
Phys 490 [M] Thesis	1	Option elective	3
Option elective	3		

NOTES:

1. Read the notes to the Standard Option.
2. Option Electives (18 credits): Choose from CE, CPT_S, EE, ME, and MSE courses not used to fulfill other requirements.
3. Physics Electives (3 credits): Choose any 300-400-level ASTRONOM or PHYSICS courses not used to fulfil other requirements.

Physics – Planetary sciences option (120 hours)

A joint program with the School of the Environment.

First year			
Fall		Spring	
Equity and justice [EQJS]	3	Chem 106 Chemistry 2	4
Chem 105 [PSCI] Chemistry 1	4	Hist 105 [ROOT]	3
English 101 [WRTG]	3	Math 172 Calculus 2	4
Math 171 [QUAN] Calculus 1	4	SOE 103 or Astr 138 Planets	3
SOE 100 or Phys 188 Seminar	1		
Second year			
Cpts 111 Python	3	Biological science [BSCI]	3
Math 273 Calculus 3	2	Diversity [DIVR]	3
Phys 201 Physics 1	3	Math 220 Linear algebra	2
Phys 211 Physics lab 1	1	Phys 202 Physics 2	3
SOE 102 Geology	4	Phys 212 Physics lab 2	1
College Foreign Language Requirement	0-4	SOE 210 Earth	4
		Complete University Writing Portfolio	
Third year			
Social Sciences [SSCI]	3	Astr 435 Astrophysics 1	3
Math 315 Differential equations	3	Humanities [HUM]	3
Phys 303 Modern 1	3	Phys 304 Modern 2	3
SOE 340 [M] Structural geology	4	SOE 356 Magmatic processes	3
Stat 212 Stats	4	SOE 474 [CAPS] [M] Earth phys & chem	4
Fourth year			
Creative and professional arts [ARTS]	3	Astr 450 [CAPS] Life in the universe	3
Astr 345 Astrophysics	3	Elective	3
Technical writing [WRTG]	3	SOE 357 Metamorphic rocks	3
SOE 350 Earth materials	4	SOE 480 [CAPS] Habitable planets	3
SOE 499 or Phys 499 Research	1	Soil Sci 374 Remote sensing	3

NOTES:

1. Read the notes to the Standard Option.
2. Recommended electives include Astr 436, Chem 3xx, Data 115, Data 209, Phys 3xx or 4xx, Stat 412, SOE 3xx or 4xx.

Physics - Honors College Curriculum

Admission to the Honors College requires a separate application. Placement is competitive and the number of spaces is limited. The Honors College program is an alternate 4-year program within the university. There are College-based graduation requirements. Foreign language competency is a graduation requirement, as tested by the STAMP test. Foreign language minor degrees are popular with Honors College students. Foreign language courses should be taken in consecutive semesters.

First year			
Fall		Spring	
Chem 105 Chemistry 1	4	Chem 106 or 116 Chemistry 2	4
English 298 Writing	3	Foreign language 204	4
Foreign language 203	4	Math 172 or 182 Calc 2	4
Math 171 Calc 1	4	Phys 201/211 or 205 Physics 1	4-5
Phys 188 First year seminar 1	1	Phys 188 First year seminar 2	1
Second year			
Honors 270 Social sciences	3	Honors 290 Science	3
Math 220 or 230 Linear algebra	2	Math 315 Differential equations	3
Math 273 or 283 Calc 3	2	Phys 304 Modern 2	3
Phys 202/212 or 206 Physics 2	4-5	Phys 330 Thermal physics	3
Phys 303 Modern 1	3	Phys 410 Electronics lab	4
Assemble University Writing Portfolio			
College foreign language requirement			
Third year			
Computing requirement	2-4	Technical writing	3
Honors 280 Arts	3	Honors 398 Thesis proposal	1
Math elective	3	Math elective	3
Phys 320 Mechanics	3	Phys 342 Electricity and magnetism 2	3
Phys 341 Electricity and magnetism 1	3	Phys 415 [M] Quantum lab	3
		Phys 489 Thesis proposal	1
Fourth year			
Honors 380 Case study	3	Honors 390 Case study	3
Honors 370 Case study	3	Honors 450 Thesis	3
Phys 450 Quantum mechanics	3	Standard option electives	9
Phys 490 [M] Thesis	1	Technical elective	3
Standard option elective	3		
Technical elective	3		

NOTES:

1. Read the notes to the Standard Option.
2. Admittance to Foreign Language courses 203 and 204 requires either 101 and 102, or AP (Advanced Placement) credit, or test placement through the offering department.
3. Students should sign up to take the STAMP test after finishing the 204 course or “fourth semester” of their foreign language.

Physics - ROTC Curriculum

WSU offers three ROTC programs: Air Force, Army, and Navy. The Air Force program is in the Dept of Aerospace Studies at WSU, the Army in the Dept of Military Science at WSU, and the Navy in the Program in Naval Science at the University of Idaho (Moscow). The combined ROTC and Physics program takes 5 years (10 semesters) to complete. The program below is for the Aerospace Studies course prefix, Aero. Substitute course prefix Mil S for Military Science, or N S for Naval Studies, as appropriate.

First year			
Fall		Spring	
Aero 1XX	3	Aero 1XX	3
Chem 105 [PSCI] Chemistry 1	4	Chem 106 Chemistry 2	4
English 101 [WRTG]	3	Math 172 Calc 2	4
Math 171 Calc 1	4	Phys 189 First year seminar 2	1
Phys 188 First year seminar 1	1	Phys 201/211 or 205 Physics 1	4-5
Second year			
Aero 2XX	3	Aero 2XX	3
Math 220 Linear algebra	2	History 105 [ROOT]	3
Math 273 Calc 3	2	Math 315 Differential equations	3
Phys 202/212 or 206 Physics 2	4-5	Physics 304 Modern 2	3
Physics 303 Modern 1	3	Phys 410 Electronics Lab	4
Third year			
Aero 3XX	5	Aero 3XX	5
Computing requirement	2-4	Phys 330 Thermal physics	3
Phys 320 Classical mechanics	3	Phys 342 Electricity and magnetism 2	3
Phys 341 Electricity and magnetism 1	3	Physics 415 [M] Quantum lab	3
Biological sciences [BSCI]	3	Standard option elective	3
Fourth year			
Aero 4XX	5	Aero 4XX	5
Humanities [HUM]	3	Math elective	3
Math elective	3	Phys 489 Thesis proposal	1
Social science [SSCI]	3	Technical elective	3
Technical elective	3	Creative and professional arts [ARTS]	3
Fifth year			
Aero 499	1	Aero 499	1
Technical writing [WRTG]	3	Standard option electives	9
Phys 450 Quantum mechanics	3	Capstone [CAPS]	3
Phys 490 [M] Thesis	1	Equity [EQJS]	3
Standard option elective	3		
Diversity [DIVR]	3		

NOTES:

1. Read the notes in the Standard Option.

Course Descriptions, Physics & Astronomy

Courses for Majors

On the following pages are descriptions of courses offered in the Department of Physics and Astronomy, including a list of the textbooks used in recent years.

Phys 188 and 189: First-Year Seminar

188 First-Year Seminar I 1 Faculty will present current research interests and opportunities in physics: questions and discussion. Taught annually each fall. S, F grading.

189 First-Year Seminar II 1 Course Prerequisite: PHYSICS 188. Continuation of PHYSICS 188; faculty will present current research interests and opportunities in physics; questions and discussions. S, F grading.

A weekly seminar where students meet members of the Department of Physics & Astronomy and learn about opportunities for undergraduate research. Small assignments and projects teach academic skills.

Recent texts

OPIS! Our place in space, by Reichart (WebAssign)

Your College Experience, by Gardner, Jewler, and Barefoot (Bedford St. Martin's)

Phys 201/211 and 202/212: Physics for Scientists and Engineers

201 [PSCI] Physics for Scientists and Engineers I 3 Course Prerequisite: PHYSICS 211 or concurrent enrollment; MATH 171 with a C or better, or credit for or concurrent enrollment in MATH 172, 182, 273, or 315. Calculus-based physics; topics in motion and dynamics of particles and rigid bodies, vibrations, wave phenomena, and the laws of thermodynamics.

211 [PSCI] Physics Lab for Scientists and Engineers 1 (0-3) Course Prerequisite: MATH 171 with a C or better, MATH 172 or concurrent enrollment, MATH 182 or concurrent enrollment, MATH 273 or concurrent enrollment, or MATH 315 or concurrent enrollment; PHYSICS 201 or concurrent enrollment. Calculus-based physics lab; topics in motion and dynamics of particles and rigid bodies, vibrations, wave phenomena, and the laws of thermodynamics.

202 Physics for Scientists and Engineers II 3 Course Prerequisite: 4 credits of PHYSICS 201 with a C or better, or PHYSICS 201 and 211 with a C or better, or PHYSICS 205 with a C or better; PHYSICS 212 or concurrent enrollment; MATH 172 or 182 with a C or better. Calculus-based physics, topics in electricity, magnetism, electromagnetics, D/C and A/C circuits, optics, reflection, refraction, interference, diffraction, polarization.

212 Physics Lab for Scientists and Engineers II 1 (0-3) Course Prerequisite: PHYSICS 202 or concurrent enrollment; PHYSICS 201 with a C or better or PHYSICS 205 with a C or better; MATH 172 with a C or

better or MATH 182 with a C or better. Calculus-based physics labs, topics in electricity, magnetism, electromagnetics, D/C and A/C circuits, optics, reflection, refraction, interference, diffraction, polarization.

A fuller discussion of these courses follows the note on Physics 205 and 206.

Recent texts

University Physics, by Moebs, Ling, & Sanny (OpenStax)

Physics for scientists and engineers: a strategic approach with modern physics, by Knight

Physics, by Tipler

Physics, by Fishbane, Gasiorowicz and Thornton

Physics, by Walker

Phys 205 and 206: Honors Section of Physics for Scientists and Engineers

We encourage our Physics majors to enroll in the Honors versions of 201 and 202. The classes are much smaller than 201 and 202, and there is a recitation session built into the class where students work problems with the instructor and our graduate students. The material is more challenging, and the class overall is better preparation for higher-level physics. Five credit hours are awarded for each of these classes.

Mathematics Prerequisites

This course makes use of integral and differential calculus, with the level and extent of usage gradually increasing from little, in Physics 201 to full use in Physics 202. Calculus I (Math 171 or Math 181) must be completed before or taken concurrently with Physics 201 and Calculus II (Math 172 or Math 182) must be completed before Physics 202. If you have completed a high school physics course, concurrent enrollment in Math 171 is sufficient preparation for Physics 201, even if your high school course was not sufficient for you to bypass Math 171. If you have not had a high school calculus class, you should complete Math 171 before taking Physics 201.

Designed for Engineers and Physical Scientists

Physics 201 and 202 are required for majors in mathematics, the physical sciences, and engineering; for biological science majors contemplating research careers; and, for all students (with sufficient preparation in mathematics) who prefer these courses to less technical courses to make full use of their background.

Laboratory

Physics 201/211 (205) and 202/212 (206) both have a laboratory integral to the course. The laboratory's purposes are to introduce basic measuring and data handling techniques, illustrate some of the principles of physics and explore their limitations.

An Integrated Sequence: Phys 201, 202, 303, and 304

Physics 201 and 202 constitute a survey of classical physics, mechanics, heat, sound, electricity, magnetism, and light. Physics 303 and 304 survey the more recent theories of relativity, atomic physics, nuclear physics, and solid state physics. Physics 303 and 304 are the continuation and culmination of Physics 201 and 202. It is hard to overestimate the impact of the fascinating and important ideas of modern physics. These ideas not only dominate our understanding of nature but also have far reaching applications in technology.

Phys 303 and 304: Modern Physics

303 Modern Physics I 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212 or concurrent enrollment, or PHYSICS 206 or concurrent enrollment; MATH 220 or concurrent enrollment or MATH 230 or concurrent enrollment. Quantum and relativity theories with applications to atomic, solid state, nuclear and elementary particle physics

304 Modern Physics II 3 Course Prerequisite: PHYSICS 303. Continuation of PHYSICS 303.

Recent texts

Physics for scientists and engineers: a strategic approach with modern physics, by Knight

Modern physics, by Krane

Modern Physics, by Serway, Moses, & Morway

Modern Physics, by Harris

Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, by Eisberg and Resnick

Physics 320 Mechanics

320 Mechanics 3 Course Prerequisite: MATH 315 or concurrent enrollment; MATH 220 or concurrent enrollment or MATH 230 or concurrent enrollment; 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206. Particle motion in one-, two-, and three-dimensions; motions of systems of particles; rigid body motion; Lagrange's equations.

Recent texts

Classical Mechanics, by Taylor

Classical Dynamics of Particles and Systems, by Marion and Thornton

Classical Mechanics, by Barger and Olsson

Phys 330 Thermal Physics

330 Thermal Physics 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206; MATH 273 or 283. Thermal behavior of systems; energy and entropy; equations of state; changes of phase; elements of continuum and statistical approaches.

Recent texts

Statistical physics: Berkeley physics course vol 5, by Reif

Statistical and thermal physics with computer applications, by Gould and Tobochnik

Thermal Physics, by Kittel and Kromer

Thermodynamics, Kinetic Theory and Statistical Mechanics, by Sears and Salinger

Heat and Thermodynamics, by Zemansky and Dittman

Phys 341 and 324 Electricity & Magnetism

341 Electricity and Magnetism I 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206; MATH 315 or concurrent enrollment. Electrostatic fields, magnetic fields, dielectric and magnetic media.

342 Electricity and Magnetism II 3 Course Prerequisite: PHYSICS 341. Continuation of PHYSICS 341. Maxwell's equations; electromagnetic waves, special relativity.

Recent texts

Introduction to Electrodynamics, by Griffiths

Astr 345 Principles of Astronomy

345 Principles of Astronomy 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206; MATH 172 or 182. Planets, the sun, stars, and galaxies; current topics in astrophysics and planetary research.

Recent texts

Introduction to High Energy Astrophysics, by Rosswog (Cambridge University Press)

Cosmic Catastrophes, by Wheeler

Moons and Planets, by Hartmann

Introduction to Astronomy and Astrophysics, by Zeilik & Gregory

Astronomy, A Physical Perspective, by Kutner

Foundations of Astrophysics, by Ryden and Peterson

Phys 410 Electronics Laboratory

410 Electronics 4 (2-6) Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206. Laboratory construction and investigation of electronic circuits employed in research instruments.

Recent texts

Basic Electronics: An Introduction to Electronic for Science Students, by Meyer

Analog Electronics for Scientific Applications, by Barnall

Digital and Microprocessor Electrical Science, by Barnall

Phys 415 Quantum Physics Laboratory

415 [M] Quantum Physics Laboratory 3 (2-3) May be repeated for credit; cumulative maximum 6 hours. Course Prerequisite: PHYSICS 304. Experiments in modern and quantum physics, fundamental interactions of radiation with matter.

Recent Texts

Experiments in Modern Physics, by Melissinos

An Introduction to Error Analysis, by Taylor

Astr 435 and 436 Astrophysics

435 Astronomy and Astrophysics I 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206; MATH 172 or 182. Planets, solar systems, and stars.

436 Astronomy and Astrophysics II 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206; MATH 172 or 182. Exotic objects, galaxies, and cosmology.

These courses are offered in alternate years and may be taken in any order.

Recent texts

An Introduction to Modern Astrophysics, by Carroll and Ostlie

Introduction to Cosmology, by Ryden

Phys 443 Optics

443 Optics 3 Course Prerequisite: PHYSICS 341 or concurrent enrollment. Polarization, interference, coherence, and diffraction phenomena of the electromagnetic spectrum; optics of solids; laser resonators; gaussian beams; ABCD matrices.

Recent texts

Optics, by Hecht (Addison Welsey)

Modern Optics, by Guenther

Introduction to Modern Optics, by Fowles

Phys 450 Quantum Mechanics

450 Introduction to Quantum Mechanics 3 Course Prerequisite: MATH 315; PHYSICS 303. Introduction to quantum theory with applications to atomic physics. Cooperative: Open to UI (University of Idaho) degree-seeking students.

Recent texts

Principles of Quantum Mechanics, by Shankar

Introduction to Quantum Mechanics, by Griffiths

Introductory Quantum Mechanics, by Liboff

Quantum Mechanics, by Gasiorowitz

Physics 455 Quantum technologies and computation

455 Quantum Technologies and Computation 3 Fundamentals of quantum mechanics required for quantum computing and quantum information science; technologies and platforms that enable quantum applications to computing, simulation, and advance sensing. Credit not granted for both PHYSICS 455 and PHYSICS 555. Offered at 400 and 500 level.

Recent texts

Quantum computation and quantum information, by Nielsen & Chuang

Physics 461 Atomic and Molecular Physics

461 Introduction to Atomic and Molecular Physics 3 Course Prerequisite: PHYSICS 304. Introduction to atomic and molecular physics; spectroscopy.

Recent texts

Atomic Physics, by Foot

Atomic Physics, by Jones

Phys 463 Solid State Physics

463 Introduction to Solid State and Materials Physics 3 Course Prerequisite: PHYSICS 304. Introduction to the physics of solids; crystal structures, lattice vibrations, and electron theory. Cooperative: Open to UI degree-seeking students.

Recent texts

Solid State Physics, by Ashcroft & Mermin

Introduction to Solid State Physics, by Kittel

Solid State Physics, by Burns

Phys 465 Nuclear Physics

465 Introductory Nuclear Physics 3 Course Prerequisite: PHYSICS 304. Nuclear systematics, apparatus of nuclear research, radioactivity, nuclear-atomic interactions, nuclear reactions, and scattering; introductory particle physics. Cooperative: Open to UI degree-seeking students.

Recent texts

Introductory Nuclear Physics, by Krane

Phys 466 Biological Physics

466 Biological Physics 3 Course Prerequisite: 4 credits of PHYSICS 202, or PHYSICS 202 and 212, or PHYSICS 206; CHEM 106 or 116; MATH 172 or 182. Fundamental physics and thermodynamics of the cell; mechanics of biomolecular machines. Credit not granted for both PHYSICS 466 and PHYSICS 566. Offered at 400 and 500 level.

Recent texts

Biological Physics - Energy, Information, Life, by Nelson

Physical Biology of the Cell, by Phillips, Kondev, & Theriot

Phys 481 Special topics

481 Advanced Topics V 1-3 May be repeated for credit; cumulative maximum 6 hours. Topics in scientific and technological areas that have relative significance to physics and astronomy.

Phys 481 is offered irregularly, depending on instructors' availability.

Recent topics

Applications of Mathematica to the Physical Sciences

Physics 489 and 490 Undergraduate Thesis

489 Thesis Proposal 1 Research project directed by an approved faculty member in support of completing a thesis proposal for PHYSICS 490. S, F grading.

Thesis proposal – complete most or all research in 489 - deliverable is a proposal of what will be written in 490 – a rubric will be given to students – consider a description earlier in the handbook describing the overall layout of the BS degree, e.g., intro -> modern -> theory and experimental upper division -> thesis as a capstone experience.

490 [M] Undergraduate Thesis 1 Preliminary thesis draft of a laboratory or library research experience, oral presentation, and final draft.

An undergraduate thesis is required of all senior physics majors and satisfies a portion of the University's writing in the major requirement. Students work on a project supervised by a faculty member. A lecture component may be required in which students learn how to read and write scientific literature. At the end of the course, a written dissertation is submitted. A research poster is also presented at an end-of-semester symposium, where students give brief talks about their work.

Physics 499 Special Problems

499 Special Problems V 1-4 May be repeated for credit. Independent study conducted under the jurisdiction of an approving faculty member; may include independent research studies in technical or specialized problems; selection and analysis of specified readings; development of a creative project; or field experiences. S, F grading.

The purpose of the requirement is to involve students in an active research program. Each student must arrange with a faculty member to undertake some specific project under his/her direction. This project may be anything, such as building research apparatus, taking data, or writing or running computer programs. A paper may be required.

Credit of from 1 to 4 hours can be earned each semester and may be repeated in other semesters. In general, three hours of work per week per semester (45 hours) earns one hour credit. Any student who registers for Phys 499 must file a contract in the Physics and Astronomy Main Office with the academic secretary. This contract form is available in the Physics office and will be completed with the supervising faculty member.

Other Physics & Astronomy Courses

Other courses offered by the Dept of Physics and Astronomy are not typically taken for credit by Physics majors. They are offered to satisfy university GER/UCORE requirements for other majors, or for Physics and Astronomy minor degrees.

Astr 135 Astronomy

135 [PSCI] Astronomy 4 (3-2) Course prerequisite: ENGLISH 101 or HISTORY 105. Overview of the solar system, stars, galaxies, cosmology, and the history of astronomy. Includes a lab component with occasional evening meetings. Credit not granted for both ASTRONOM 135 and 150.

Recent texts

Astronomy, by Fraknoi, Morrison, & Wolfe (OpenStax)

Understanding Our Universe, by Kay, Palen, Smith, & Blumenthal

21st Century Astronomy, by Hester

Lecture-Tutorials for Introductory Astronomy, by Adams et al.

Astr 138 Planets and Planetary Systems

138 [PSCI] Planets and Planetary Systems 3 Course prerequisite: ENGLISH 101 or HISTORY 105. Formation and dynamics of planetary systems; major planets: interiors, surfaces, atmospheres; minor planets: moons, asteroids, comets; science missions; extrasolar planets.

Recent texts

Astronomy, by Fraknoi, Morrison, & Wolfe (OpenStax)

The Planetary System, by Morrison and Owen

Astronomy Today: The Solar System, by Chaisson and McMillan

Lecture-Tutorials for Introductory Astronomy, by Adams et al.

Astr 150 Science and the Universe

150 Science and the Universe 3 Basic structure and history of science and science reasoning with emphasis on astronomy, observational practice, and data analysis. Credit not granted for both ASTRONOM 135 and 150.

Recent texts

Discovering the Cosmos, by Bless

The Cosmic Perspective, by Bennett

Lecture-Tutorials for Introductory Astronomy, by Adams et al.

Astr 390 The Night Sky

390 [PSCI] The Night Sky 1 (0-3) Course Prerequisite: Science [BSCI] or [PSCI] UCORE course. Star names, magnitude scales, constellation identification, astronomical coordinates, solar, lunar, and planetary motions, practical astronomy. Some outdoor evening time required.

Recent texts

The National Audubon Society Field Guide to the Night Sky

To Measure the Sky: An Introduction to Observational Astronomy, by Chromey

An Introduction to Observational Astrophysics, by Gallaway

Observational Astronomy, by Birney, Gonzalez, and Oesper

Astr 450 Life in the Universe

450 [CAPS] Life in the Universe 3 Course Prerequisite: Mathematics [N] or [QUAN]; junior standing. The natural history of life on earth and prospects for life elsewhere; includes chemistry, biology, geology,

physics, and astronomy. Recommended preparation: Completion of physical and biological sciences GERs/UCOREs.

Recent texts

Life in the Solar System and Beyond, by Jones

Life in the Universe, by Bennett and Shostak

The Search for Life in the Universe, by Goldsmith and Owen

The Origins of Life in the Universe, by Jastrow and Rampino

Phys 101/111 and 102/112 General Physics

101 [PSCI] General Physics 3 Course Prerequisite: PHYSICS 111 or concurrent enrollment; MATH 108 with a grade of C or better, a minimum ALEKS math placement score 75%, or passing MATH 140, 171, 202, or 206. Algebra/trigonometry-based physics; topics in mechanics, wave phenomena, temperature, and heat; oriented toward non-physical science majors.

111 [PSCI] General Physics Lab 1 (0-3) Course Prerequisite: MATH 108 with a grade of C or better, a minimum ALEKS math placement score 75%, or passing MATH 140, 171, 202, or 206; PHYSICS 101 or concurrent enrollment. Algebra/trigonometry-based physics labs; topics in mechanics, wave phenomena, temperature, and heat; oriented toward non-physical science majors.

102 General Physics 3 Course Prerequisite: 4 credits of PHYSICS 101 with a C or better, or PHYSICS 101 and 111 with a C or better; PHYSICS 112 or concurrent enrollment; MATH 108 with a grade of C or better, a minimum ALEKS math score 75%, or passing MATH 140, 171, or 202. Algebra/trigonometry-based physics; topics in electricity, magnetism, optical phenomena, relativity, and quantum theory; oriented toward non-physical science majors.

112 General Physics Lab II 1 (0-3) Course Prerequisite: PHYSICS 102 or concurrent enrollment. Algebra/trigonometry-based physics lab; topics in electricity, magnetism, optical phenomena, relativity, and quantum theory; oriented toward non-physical science majors.

Recent texts

College Physics, by Urone and Hinrichs (OpenStax)

Physics, by Walker

Study Guide to Accompany Physics, by Walker

Schaum's Guide: Beginning Physics I

Real Time Physics, Module 1 (Mechanics), by Sokoloff

Phys 137 Physics and Society

137 [PSCI] Physics and Society 3 Course Prerequisite: Minimum ALEKS math placement score of 45% or MATH 103 or higher with a C or better. Enrollment is not allowed if credit already earned for PHYSICS 408. Interactions of physics with society; energy; air and water pollution; recycling; communications and computers; physics and war; physics and art. Credit not allowed for students who have earned credit for PHYSICS 408. Recommended preparation: UCORE [QUAN].
Offered via Global Campus only. Previous listings: Physics 408 [CAPS], Phys 380 [P].

Recent texts

Physics: concepts & connections, by Hobson

Phys 150 Physics and your World

150 [PSCI] Physics and Your World 3 Survey of physics as found in everyday phenomena, including many hands-on activities and home experiments.

Phys 322 Sound waves and music

322 [PSCI] Sound Waves and Music 4 (3-3) Course Prerequisite: MATH 103 or higher with a C or better or a minimum ALEKS math placement score of 45%. Multi-disciplinary introduction to the acoustics of musical sound with a hands-on approach, including human hearing and perception.

Recent texts

Physics and music: the science of musical sound, by White