Term Information

Effective Term	Spring 2023
Previous Value	*Summer 2012*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

1. Change to prerequisites

2. Course number

What is the rationale for the proposed change(s)?

1. We want to add an introductory programming course as a prerequisite to make sure students have the introductory programming knowledge necessary for the course. A programming course is already required for the major (and is a prerequisite for Physics 3700, a required course), so this won't add a burden to our students. We also want to reduce the physics prerequisite from Physics 5501 (Quantum Mechanics II) to Physics 5500 (Quantum Mechanics I) for two reason: One - because Physics 5501 is not a required course and fewer than half of our students take it. And two - because this will allow students to take Physics 6810/5810 during spring of their junior year instead of only having the option to take it spring of senior year.

2. I've attached a separate document that discusses the rationale for changing the course number.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

More flexibility with scheduling. Additionally, these changes will allow us to move forward with creating a computational physics certificate.

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Physics
Fiscal Unit/Academic Org	Physics - D0684
College/Academic Group	Arts and Sciences
Level/Career	Graduate, Undergraduate
Previous Value	*Graduate*
Course Number/Catalog	5810
Previous Value	*6810*
Course Title	Topics in Computational Physics
Transcript Abbreviation	Computational Phys
Course Description	Experimental and theoretical aspects of areas of current interest in Computational Physics.
Semester Credit Hours/Units	Fixed: 4

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade

Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	CSE 1222, CSE 1223, CSE 1224, Astronomy 1221, Engineering 1221, or Engineering 1281H; and Physics 5500
Previous Value	*Prereq: 5501 or grad standing or permission of instructor.*
Exclusions	
Electronically Enforced	Yes
Previous Value	**No**

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0899
Subsidy Level	Doctoral Course
Intended Rank	Junior, Senior, Masters, Doctoral
Previous Value	*Senior, Masters, Doctoral*

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Write correct, clear, and well-documented computer code.
- Know some of the tools (algorithms) of computational Physics.
- Understand the limitations of computational solutions to Physics problems.
- Understand where computational solutions to Physics problems are better than analytical solutions.
- Have a better understanding of Physics through having to put Physics concepts into code.
- Have a better understanding of Physics through playing with numerical solutions to Physics problems.

Previous Value

Content Topic List

- Unix environment and how to write a computer program
- Rounding errors in floating point arithmetic
- Using scientific computing libraries
- Numerical differentiation and integration
- Parallel processing
- Solving Linear algebra, differential equations, and quantum mechanics problems with programming
- Oscillations, pendulums, and chaos
- Debugging, optimizing, and profiling
- Random numbers and Monte Carlo methods
- Ising model

Previous Value

- *Computational Physics: Topics to be announced each semester*

Sought Concurrence

No

Attachments

- Physics5810Syllabus.pdf: Physics 5810 Syllabus

  (Syllabus. Owner: Thaler,Lindsey Nicole)
- physics6810syllabus.pdf: Physics 6810 Syllabus (for comparison)

  (Syllabus. Owner: Thaler,Lindsey Nicole)
- Request.pdf: Explanation for course request

  (Cover Letter. Owner: Thaler,Lindsey Nicole)
- Sample_Plan.pdf: Sample Academic Plan

  (Other Supporting Documentation. Owner: Thaler,Lindsey Nicole)
- Curriculum_Map.pdf: Curriculum Map

  (Other Supporting Documentation. Owner: Thaler,Lindsey Nicole)

Comments

- Curriculum Map is now attached. *(by Thaler,Lindsey Nicole on 06/06/2022 11:00 AM)*
- A curriculum map has been requested, so we request to put this on hold until we generate one. *(by Humanic,Thomas John on 05/10/2022 09:31 AM)*
- If this course will count in your major, could you please provide an updated curriculum map indicating which major goal(s) are fulfilled by this class and at what level? *(by Vankeerbergen,Bernadette Chantal on 03/21/2022 04:24 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Thaler,Lindsey Nicole	03/10/2022 11:52 AM	Submitted for Approval
Approved	Humanic,Thomas John	03/10/2022 01:46 PM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	03/21/2022 04:25 PM	College Approval
Submitted	Humanic,Thomas John	03/21/2022 04:35 PM	Submitted for Approval
Revision Requested	Humanic,Thomas John	05/10/2022 09:31 AM	Unit Approval
Submitted	Thaler,Lindsey Nicole	06/06/2022 11:00 AM	Submitted for Approval
Approved	Humanic,Thomas John	06/06/2022 11:34 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	08/31/2022 12:52 PM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	08/31/2022 12:52 PM	ASCCAO Approval

This request is to renumber a course from Physics 6810 (Computational Physics) to Physics 5810.

the course was designed during the quarter to semester transition for advanced undergraduates and first year graduate students. It was wrongly assumed at the time that 6,000 was the appropriate numbering for this. We have lived with this situation for a number of years, but recently it has surfaced as a problem as we are trying to create a computational physics certificate aimed at undergraduate students. The problem is that most of the physics courses required for this certificate are taught as 6000-level courses, that we have learned are not allowed to be used in an undergraduate certificate.

Both the Physics Graduate Studies Office and the Physics Undergraduate Studies Office approve of this change.

Syllabus:
Physics 5810
Computational Physics
Spring 2023

Course Information

- **Course times:**
  Lecture: Wednesdays & Fridays 12:40-2:45pm
- **Credit hours:** 4
- **Mode of delivery:** In person

Instructor

- **Name:** Ralf Bundschuh
- **Email:** bundschuh.2@osu.edu
- **Office location:** 2064 Physics Research Building
- **Office hours:** After class and any time I am in my office

Computer Consultant

- **Name:** Terry Bradley
- **Email:** Bradley.77@osu.edu
- **Office location:** 1199 Physics Research Building

Course Prerequisites

Prerequisites: CSE 1222, CSE 1223, CSE 1224, Astronomy 1221, Engineering 1221, or Engineering 1281H; and Physics 5500

It will be expected that you have some experience with one or more of: Mathematica, MATLAB, Python, C, fortran, or C++. The teaching strategy is to give you computer programs and have you run and then modify (or debug) them as you follow along through worksheets. Let me know if you are concerned about your preparation (e.g., if you have very limited experience).

Course Description

Experimental and theoretical aspects of areas of current interest in Computational Physics.

The goal of the course is to make every student comfortable in addressing physics problems using computational methods. Given that in contrast to the physics textbook's end-of-chapter problems, hardly any real life problems can be solved using pencil and paper, being comfortable using computational methods is a very important skill for every physicist. Being comfortable addressing physics problems with computers means knowing how to write good code, but also understanding the shortfalls of computational algorithms, and how to evaluate a computation's results for plausibility rather than just believing that everything that comes out of a computer must be correct. The course will address all these issues. In addition, we will hopefully also learn a bit of interesting physics that can only be addressed computationally; it is a physics course after all! Since the only way to learn computation is by doing, lecturing will be minimal and most of the class time will be spent hands on working through worksheets on the computers in the classroom (or your own).

The course will cover the following topics:

- Unix environment and how to write a computer program
- Rounding errors in floating point arithmetic
- Using scientific computing libraries
- Numerical differentiation and integration
- Solving Linear algebra, differential equations, and quantum mechanics problems with programming
- Parallel processing
- Oscillations, pendulums, and chaos
- Debugging, optimizing, and profiling
- Random numbers and Monte Carlo methods
- Ising model

Learning Outcomes

1. Write correct, clear, and well-documented computer code.
2. Know some of the tools (algorithms) of computational Physics.
3. Understand the limitations of computational solutions to Physics problems.
4. Understand where computational solutions to Physics problems are better than analytical solutions.
5. Have a better understanding of Physics through having to put Physics concepts into code.
6. Have a better understanding of Physics through playing with numerical solutions to Physics problems.

How This Course Works

Mode of delivery: This course expected to be delivered in person.

Credit hours and work expectations: This is a 4 credit-hour course. According to Ohio State bylaws on instruction (go.osu.edu/credit hours), students should expect around 4 hours per week of time spent on direct instruction in addition to 8 hours outside of class to receive a grade of [C] average.

Attendance, grading, and participation requirements:

Pre-class readings (10%)
For most class periods, you will be expected to complete a reading assignment before class. These will be announced in class and on Carmen. On days with reading assignments you have to answer some questions about the reading using the "Quizzes" feature of Carmen by 3:59am the day of class. Your answers will not be graded; the only requirement is that you submit the questionnaires on time. Your credit for this section of the course is the fraction of the reading assignment feedbacks that you have submitted on time.

In-class worksheets (30%)
We will be spending most of the class time working in pairs on computational problems. As you are doing so, you will be filling out worksheets, which are handed in at the end of every section of the course. These worksheets will be graded using categories of outstanding (12 points), adequate (11 points), or needs improvement (10 points). The in-class worksheets can be submitted for unlimited re-grading until four weeks after they were first handed out or April 24 whichever comes first. The four week due date will be announced on the worksheet and in Carmen. It is firm in order to avoid procrastination.

Problem Sets (30%)
Problem sets will be due roughly every other week. They serve to ensure a thorough understanding of the material worked on in class. Since we all have many other commitments, they will be rather limited in length. The problem sets will also be graded using the categories of outstanding (12 points), adequate (11 points), or needs improvement (10 points). As long as you hand something showing credible effort in by the due date, you are allowed to make improvements based on grading comments until four weeks after the due date or April 24, whichever comes first.

Final project (30%)
In the latter half of the semester you will be asked to come up with a project of your own choice. There will be examples but you are also welcome to choose something from your own research as long as it involves computation. These projects are due on the last day of class, in Carmen. They will be graded using the same categories as the in-class worksheets and the homework. You are encouraged to discuss your projects with me as you are working on them.

Attendance (0%)
While I will not specifically take attendance, this being a hands-on class means that it just does not make any sense without you attending. Also note, that the in-class worksheets make up 30% of the grade. Of course, if you are sick or need to travel for a session or two let me know and I will do my best to accommodate this.

Academic integrity and collaboration: Your submitted assignments should be your own original work. We do encourage students to help each other understand the material. However, the bulk of each assignment should be - unambiguously - each student's own work. Science is a collaborative field and so working together is important, but one must be careful to distinguish one's own contributions from those of others.

Course Materials, Fees and Technologies

Required Materials and/or Technologies

There is no required text to buy but there will be readings for each class session from handouts passed out in class and background notes posted online. We will supplement these with readings from the 2015 lecture notes by Morten Hjorth-Jensen from the University of Oslo. Prof. Hjorth-Jensen's course in computational physics covers similar topics. (His course web pages: FYS3150 (Links to an external site.) and FYS4411 (Links to an external site.).) These will be posted on Carmen. For a long list of other interesting books look at the "Textbooks" page in the "Useful information" Module on Carmen.

CarmenCanvas Access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device (go.osu.edu/add-device) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Install the Duo Mobile application (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- Navigating CarmenCanvas (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat**: go.osu.edu/it
- **Phone:** 614-688-4357 (HELP)
- **Email:** servicedesk@osu.edu

Digital Flagship

Digital Flagship is a student success initiative aimed at helping you build digital skills for both college and career. This includes offering an engaging collection of digital tools and supportive learning experiences, university-wide opportunities to learn to code, and a Design Lab to explore digital design and app development. Digital Flagship resources available to help Ohio State students include on-demand tutorials, The Digital Flagship Handbook (your guide for all things tech-related), workshops and events, one-on-one tech consultations with a peer or Digital Flagship staff member, and more. To learn more about how Digital Flagship can help you use technology in your courses and grow your digital skills, visit go.osu.edu/dfresources.

What to do if you feel like you are falling behind

Reach out! Contact an instructor or TA, and we can help you develop strategies to help. We also strongly recommend that you form study groups--interacting with other humans helps solidify concepts. Everyone in the group brings a different perspective and skillset to the table.

Grading Scale

The grade for this class is determined by a weighted average of pre-class readings, in-class worksheets, homework assignments, and a final project. There will be no curve grading and I hope that everybody will get an A. The final grades will be determined according to the standard OSU scheme:

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

Other Course Policies

Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across to others.

Academic Integrity Policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this online class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.
If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options on Ohio State's Title IX website (titleix.osu.edu) or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information, visit the OIE website (equity.osu.edu) or email equity@osu.edu.

Commitment to a Diverse and Inclusive Learning Environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand mental health resources (go.osu.edu/ccsondemand) are available. You can reach an on-call counselor when CCS is closed at 614- 292-5766**. 24-hour emergency help** is available through the National Suicide Prevention Lifeline website (suicidepreventionlifeline.org) or by calling 1-800-273-8255(TALK). The Ohio State Wellness app (go.osu.edu/wellnessapp) is also a great resource.

Syllabus

Contact information

	Ralf Bundschuh		1094 Instructor: TBA
Office:	2064 Physics Research Building	**Office:**	TBA Physics Research Builduing
Office hours:	after class and any time I am in my office	**Office hours:**	by appointment
Phone (office):	(614) 688-3978	**Email:**	TBA
Phone (home):	(614) 363-5177		
Email:	bundschuh@mps.ohio-state.edu		

	Computer Consultant: Terry Bradley
Office:	1199 Physics Research Building
Phone:	(614) 292-8598
Email:	bradley.77@osu.edu

General information

Call number:	22530
Classes:	WF 12:40-2:45
Location:	1094 Smith Lab
First class:	January 8
No class:	March 11/13 (Spring Break)
Last class:	April 17
Units:	4

Objectives

The goal of the course is to make every student comfortable in addressing physics problems using computational methods. Given that in contrast to the physics textbook's end-of-chapter problems, hardly any real life problems can be solved using pencil and paper, being comfortable using computational methods is a very important skill for every physicist. Being comfortable addressing physics problems with computers means knowing how to write good code, but also understanding the shortfalls of computational algorithms, and how to evaluate a computation's results for plausibility rather than just believing that everything that comes out of a computer must be correct. The course will address all these issues. In addition, we will hopefully also learn a bit of interesting physics that can only be addressed computationally; it is a physics course after all! Since the only way to learn computation is by doing, lecturing will be minimal and most of the class time will be spent hands on working through worksheets on the computers in the classroom (or your own).

In short, our **goals** for the course are to be able to:

1. Write correct, clear, and well-documented computer code.
2. Know some of the tools (algorithms) of computational Physics.
3. Understand the limitations of computational solutions to Physics problems.
4. Understand where computational solutions to Physics problems are better than analytical solutions.
5. Have a better understanding of Physics through having to put Physics concepts into code.
6. Have a better understanding of Physics through playing with numerical solutions to Physics problems.

Prerequisites

The prerequisites are basic physics knowledge including some quantum mechanics. It will be expected that you have some experience with one or more of Mathematica, MATLAB, Python, C, fortran, or C++. The teaching strategy is to give you computer programs and have you run and then modify (or debug) them as you follow along through worksheets. Let me know if you are concerned about your preparation (e.g., if you have very limited experience).

Outline

The course will cover the following topics:

- Unix environment and how to write a computer program
- Rounding errors in floating point arithmetic
- Using scientific computing libraries
- Numerical differentiation and integration
- Linear algebra and quantum mechanics
- Parallel processing
- Solving differential equations
- Oscillations, pendulums, and chaos
- Debugging, optimizing, and profiling
- Random numbers and Monte Carlo methods
- Ising model

Textbook

There is no required text to buy but there will be readings for each class session from handouts passed out in class and background notes posted online. We will supplement these with readings from the 2015 lecture notes by Morten Hjorth-Jensen from the University of Oslo. Prof. Hjorth-Jensen's course in computational physics covers similar topics. (His course web pages: FYS3150 (Links to an external site.) and FYS4411 (Links to an external site.).) These will be posted on Carmen. For a long list of other interesting books look at the "Textbooks" page in the "Useful information" Module on Carmen.

Grading

The grade for this class is determined by a weighted average of pre-class readings, in-class worksheets, homework assignments, and a final project. There will be no curve grading and I hope that everybody will get an A. The final grades will be determined according to the standard OSU scheme:

percentage	grade
93%-100%	A
90%-93%	A-
87%-90%	B+
83%-87%	B
80%-83%	B-
77%-80%	C+
73%-77%	C
70%-73%	C-
67%-70%	D+
60%-67%	D
0%-60%	E

Pre-class readings (10%)

For most class periods, you will be expected to complete a reading assignment before class. These will be announced in class and on Carmen. On days with reading assignments you have to answer some questions about the reading using the "Quizzes" feature of Carmen by 3:59am the day of class. Your answers will not be graded; the only requirement is that you submit the questionnaires on time. Your credit for this section of the course is the fraction of the reading assignment feedbacks that you have submitted on time.

In-class worksheets (30%)

We will be spending most of the class time working in pairs on computational problems. As you are doing so, you will be filling out worksheets, which are handed in at the end of every section of the course. These worksheets will be graded using categories of outstanding (12 points), adequate (11 points), or needs improvement (10 points). The in-class worksheets can be submitted for unlimited re-grading until four weeks after they were first handed out or April 24 whichever comes first. The four week due date will be announced on the worksheet and in Carmen. It is firm in order to avoid procrastination.

Problem Sets (30%)

Problem sets will be due roughly every other week. They serve to ensure a thorough understanding of the material worked on in class. Since we all have many other commitments, they will be rather limited in length. The problem sets will also be graded using the categories of outstanding (12 points), adequate (11 points), or needs improvement (10 points). As long as you hand something showing credible effort in by the due date, you are allowed to make improvements based on grading comments until four weeks after the due date or April 24, whichever comes first.

Final project (30%)

In the latter half of the semester you will be asked to come up with a project of your own choice. There will be examples but you are also welcome to choose something from your own research as long as it involves computation. These projects are due on the last day of class, Friday, April 17, in Carmen. They will be graded using the same categories as the in-class worksheets and the homework. You are encouraged to discuss your projects with me as you are working on them.

Attendance (0%)

While I will not specifically take attendance, this being a hands-on class means that it just does not make any sense without you attending. Also note, that the in-class worksheets make up 30% of the grade. Of course, if you are sick or need to travel for a session or two let me know and I will do my best to accommodate this.

Special needs

Students with any special needs are asked to inform me at their earliest convenience.

Advanced Physics Option

Year	Autumn Semester	Credit Hours	Comment		Spring Semester	Credit Hours	Comment
1	Physics 1250	5	Intro Physics I		Physics 1251	5	Intro Physics II
	Math 1151	5	Calculus I		Math 1152	5	Calculus II
	ASC 1100	1	Survey		CSE 1222°	3	C++ Programming
	Foreign Lang. 1	4			Foreign Lang. 2	4	
	Total Hours	**15**			**Total Hours**	**17**	
2	Physics 2300	4	Mechanics I		Physics 2301	4	Mechanics II
	Physics 2095	1	Seminar		Physics 3700	3	Data Ana. Lab
	Math 2153	4	Calculus III		Math 2415†	3	Diff. Equations
	Foreign Lang. 3	4			Gen Ed	3	
	Gen Ed	3			Gen Ed	3	
	Total Hours	**16**			**Total Hours**	**16**	
3	Physics 5500	4	Quantum I		Physics 5501	4	Quantum II
	Physics Elective*	3			Physics 5400	4	E&M
	Gen Ed	3			Gen Ed	3	
	Gen Ed	3			Gen Ed	3	
	Free Elective◊	3					
	Total Hours	**16**			**Total Hours**	**14**	
4	Physics 5600	4	Stat. Mech.		Physics 5300	4	Theoretical Mech.
	Physics 5700	3	Senior Lab		Physics 5810**	4	Computational Phy
	Gen Ed	3			Gen Ed	3	
	Free Elective◊	4			Free Elective◊	3	
	Total Hours	**14**			**Total Hours**	**14**	

(Yellow) Courses in YELLOW are only offered during the term shown

(Blue) Enrollment information can be found at physics.osu.edu/controlled-access-courses

Yellow: Physics 2300, Physics 2095, Physics 2301, Physics 5500, Physics 5501, Physics 5400, Physics 5600, Physics 5300. Blue: Physics 3700, Physics 5700, Physics 5810**.

* Acceptable physics electives include Physics 3470, Physics 3201H (if not taken as a lab), and Physics 5680 (if not taken as a lab)

** or Physics 5680 (Big Data Analytics) or Physics 4700 (Electronics Lab) or Physics 3201H (Holography)

† or 2174 or 2255 or 5520H. Linear Algebra (Math 2568) is recommended, but not required.

°or CSE 1223 or CSE 1224 or Astronomy 1221 or Engineering 1221 or Engineering 1281H

◊ Free electives are only required if a student needs to take extra courses in order to reach the minimum 121 credit hour requirement set by the College of Arts and Sciences.

		Physics Major Program Outcomes				
		Undergraduate Physics majors aquire a basic mastery of fundamental areas of physics, from classical mechanics, though electromagnetism, and finally to modern physics including quantum mechanics and relativity.	Undergraduate Physics majors develop powerful analytical and problem solving skills in areas involving both physics and mathematics.	Undergraduate Physics majors aquire a basic mastery of experimental physics.	Undergraduate Physics majors acquire a basic mastery of data reduction and error analysis.	Undergraduate Physics majors effectively communicate their physical understanding both professionally and colloquially (orally and in writing).
required courses	Physics 2095: Physics Seminar					
	Physics 2300: Mechanics I	3	3	1		
	Physics 2301: Mechanics II	3	3	1		
	Physics 3700: Data Analysis Lab	1	3	3	3	3
	Physics 5400: Electromagnetism	3	3			
	Physics 5500: Quantum Mechanics	3	3			
	Physics 5700: Physics Senior Lab	2	3	3	3	3
required 3rd lab (choose 1)	Physics 3201: Holography	2	3	3		2
	Physics 4700: Electronics Lab	2	3	3	2	3
	Physics 5680: Big Data Analytics	1	3	2	3	1
	Physics 5810: Computational Physics	1	3	2	2	2

Relationship: 1 light, 2 intermediate, 3 high

Undergraduate Physics majors are apprised of and encouraged to participate in academic research, industrial research, and/or outreach activities which are consistent with their interest, ability, and post-graduation plans.
3
1
2
2
2
2