

# PHYS 102: Intro Physics for Life Science      Fall 2024

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**Instructor:** Daniel Robb  
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**Lecture Room:** Trexler 372  
**Lecture Time:** MWF 8:30-9:30  
**Office Hours:** M 2-4, Th 2-4  
(make appointments at [calendly.com/daniel\\_robb](https://calendly.com/daniel_robb))

**Course Description:** This algebra-based course provides an overview of topics in physics that are of particular importance to the life and medical sciences. The course covers mechanics, electricity and magnetism, heat, atomic and nuclear physics, fluids, waves, and instrumentation, all in the context of biological systems.

**Prerequisites:** None. Note however that familiarity with algebra, trigonometry and logarithms is expected.

**Laboratory:** You must be enrolled in the laboratory portion of this course (PHYS 102L). Working hands-on with physics in lab experiments is very important to your understanding of course concepts. Although PHYS 102L operates as a separate course, your grade in PHYS 102L counts as 25% of the course grade for PHYS 102. Please refer to the PHYS 102L syllabus for important information about the laboratory and the final lab grade. As an indication of the importance of the laboratory, note that each lab experiment not turned in by the end of the semester will lower your PHYS 102 course grade by one whole letter grade. Lab does not meet during the first week of classes. Lab sections are conducted by a different instructor, who is responsible for both conducting the lab sessions and providing the laboratory component of your grade in the class.

## Course Material:

- **Calculator (required):** A scientific calculator that can do trigonometric functions, exponentials, and logarithms is required. Graphing calculators or cellphones will not be allowed during tests.
- **Text (required):** College Physics (OpenStax) by Paul Urone and Roger Hinrichs, ISBN 9781711470825. [either paperback or electronic copy from <https://openstax.org/details/books/college-physics-2e> ]

**Learning Outcomes:** Students will be able to

- Identify relevant physical principles which underlie the dynamics of real-world situations
- Work effectively with units in order to relate physical models to observations of the physical world
- Construct organized physical analyses that demonstrate logically connected steps of thought
- Assess the validity and utility of a physical model in new contexts

**Methods of Instruction** You will learn physics from a variety of sources, including:

- textbook readings
- brief in-class lectures
- tutorials/homeworks
- laboratories in PHYS 102L
- discussions with instructor or subject tutor
- quizzes and tests

**Note that I not lecture much. Most class time will be focused on you rather than me.**

**What You Can Do:** Here are ways to get the most out of this course:

- Attend each class meeting (lecture and lab) and arrive on time.
- Read the relevant sections of the textbook before coming to class.
- Participate in class by working with your group to complete the tutorial worksheets
- Complete all group tutorial/homework assignments on time.
- Talk to me in office hours if you are having trouble with any aspect of the course.

**Final Grade** Final course grades will be assigned using the following scale:

|    |             |    |           |
|----|-------------|----|-----------|
| A  | 93% or more | C+ | 77-79.9%  |
| A- | 90-92.9%    | C  | 73-76.9%  |
| B+ | 87-89.9%    | C- | 70-72.9%  |
| B  | 83-86.9%    | D  | 60-69.9%  |
| B- | 80-82.9%    | F  | below 60% |

**Grading:** Your grade will be determined by a combination of tutorials/homeworks, reflections on participation, quizzes, exams, and lab work. The laboratory component will be awarded by your lab instructor; please see that instructor for details. The separate weightings will be:

**Tutorials/Homeworks** 15%

**Reflections on participation** 5%

**Quizzes** 10%

**Two Exams** 30% (15% each)

**Final Exam** 15%

**Laboratory** 25%

**Collaborative Work:** Groups of five students (in some cases, four students) will be formed to develop problem-solving skills/strategies. Tutorials and quizzes will be worked in groups. Exams will have both group portions and individual portions.

**Show your work:** Your solutions on tutorials, quizzes, and exams should be neat, clear, and organized. They should follow the guidelines given for solving physics problems. If you show your work in this way, you can earn substantial partial credit even if your final result is not correct. The points you earn are based mainly on the process you use and not the final result.

**Problems on Tutorials/Homeworks, Quizzes and Exams** will be graded using the following rubric:

| Score     | Description  |
|-----------|--|
| 5         | The solution is correct and the writing is clear. The instructor can easily see that the student fully understands how to solve the problem.   |
| 4         | The solution is mostly correct, but there may be some flaws. The writing is reasonably clear. There is evidence that the student understands the key concepts involved in solving the problem, but may not fully grasp all of the details.   |
| 3         | The solution is partly correct, but there are significant errors. The writing may be hard to follow in places. There is evidence that the student does not fully understand the key concepts required to solve the problem, or that the student is unable to use those concepts in an appropriate way. |
| 2 or less | The solution is either completely incorrect or incomprehensible. This may indicate that there are serious flaws in all aspects of the solution, or that the writing was so poor that it was impossible to follow.  |

## Types of assignments:

**Tutorials/Homeworks:** You will work on a tutorial worksheet with your group during every class. One person in your group (that person will rotate alphabetically by last name) will need to submit a tutorial solution to Inquire for the group to potentially receive full credit. If the tutorial solution is not submitted by the end of class, the tutorial becomes group homework, and the designated person in the group must submit a solution before midnight of that day for potential full credit. Late submissions for up to half credit can be accepted until midnight before the next class.

**Reflections on participation:** At the end of each class week, you will submit a short (100-150 word) MS Word document describing your participation in your group, and noting any concepts or problems from the tutorials that you still find challenging or confusing.

**Quizzes:** You will take periodic, announced quizzes in class with your group. Only one quiz solution need be submitted to Inquire per group. The aim is to provide you feedback on how well you and your group have understood the tutorials.

**Written Exams:** There will be 3 exams in this course (two midterms and a final) that each contain group and individual parts. Each group will turn in one group part of the exam, and each student will turn in their own individual part of the exam. Note that the final exam covers only the last third of the course, i.e. it is not a cumulative exam.

**Note:** Quizzes and exams will be open notes. Any missed quiz or exam will receive a zero unless it is an excused absence (illness, participation in a scheduled College event, etc.), which should be cleared with me before the quiz or exam. The missed quiz or exam may be made up in a way decided by the instructor.

**Academic Integrity:** Your learning and integrity are at the core of your RC education. For this reason, you must follow the College's Academic Integrity policies: you can find the policies and resources online at [https://www.roanoke.edu/inside/academic\\_affairs/academic\\_integrity](https://www.roanoke.edu/inside/academic_affairs/academic_integrity) (← clickable link).

Collaboration is an important skill, and you are encouraged to collaborate on assignments. Specifically, you will collaborate with your group on tutorial/homeworks and on quizzes, and on the group portion of exams. You may also collaborate with other students on tutorial/homeworks, but you should note the names of those students in your work. The reflections on participation and the individual portions of exams must be completed individually without collaboration.

Quizzes and exams are open-notes. Electronic devices (other than calculators) are NOT permitted during quizzes and exams. If you choose to take notes electronically, you will need to print out your notes ahead of time. Communication between students regarding quiz or exam content is prohibited until all students have completed the quiz or exam.

Regarding generative artificial intelligence tools such as ChatGPT, you may use such tools if your group becomes stuck on a tutorial question. You should cite that use in your solution, however. As a central goal of this course is to help you become independent and critical thinkers, no other use of generative AI tools is permitted in this course.

If I become aware of a possible violation of these guidelines, I am contractually obligated to report it to the Academic Integrity committee.

**Subject Tutoring:** This is located on the lower level of Fintel Library (Room 5), is open 4-9 PM, Sunday-Thursday. Subject Tutors are highly trained, current students who offer free, one-on-one (and small group) tutorials in over 80 courses taught at Roanoke College, including: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, and Social Sciences. Check out all available subjects and schedule 30- or 60- minute appointments at [www.roanoke.edu/tutoring](http://www.roanoke.edu/tutoring) (← clickable link). If you have a question, feel free to stop by, or contact us at [subject\\_tutoring@roanoke.edu](mailto:subject_tutoring@roanoke.edu) or 540-375-2590. See you soon!

**Accessible Education Services (AES):** This is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at [aes@roanoke.edu](mailto:aes@roanoke.edu) to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

**Course Schedule:** This may be adjusted by the instructor if necessary, but students will be notified of any changes, and there will be no changes to exam dates.

| Class | Date      | Topics Covered                            | Chapter              |
|-------|-----------|---|----------------------|
| 1     | Aug. 28   | Course info; Dimensions and Units         | 1.1-1.2              |
| 2     | 30        | Conversions and Significant Figures       | 1.2-1.3              |
| 3     | Sept. 2   | Position, Distance and Displacement       | 2.1-2.2              |
| 4     | 4         | Speed, Velocity and Acceleration          | 2.3-2.4              |
| 5     | 6         | Constant Acceleration Eqns in 1D          | 2.5-2.6              |
| 6     | 9         | Projectile Motion in 2D                   | 2.7                  |
| 7     | 11        | Working with Vectors                      | 3.1-3.3              |
| 8     | 13        | Forces and Newton's Three Laws            | 4.1-4.5              |
| 9     | 16        | Applications of Newton's Laws             | 4.5-4.7              |
| 10    | 18        | Work and Kinetic Energy                   | 7.1-7.2              |
| 11    | 20        | Potential Energy, Conservation of Energy  | 7.3-7.6              |
| 12    | 23        | Exam 1 Review                             |                      |
| 13    | 25        | Exam 1                                    |                      |
| 14    | 27        | Impulse and Linear Momentum               | 8.1-8.3              |
| 15    | 30        | Elastic and Inelastic Collisions          | 8.4-8.5              |
| 16    | Oct. 2    | Rotational Kinematics                     | 6.1                  |
| 17    | 4         | Relating Linear and Rotational Kinematics | 6.1-6.3              |
| 18    | 7         | Torque and Angular Acceleration           | 9.1-9.2, 10.1-10.3   |
| 19    | 9         | Simple Harmonic Motion                    | 16.1-16.4            |
| 20    | 11        | Wave Motion                               | 16.9-16.10           |
|       | 12-20     | FALL BREAK                                |                      |
| 21    | 21        | Exam 2 Review                             |                      |
| 22    | 23        | Exam 2                                    |                      |
| 23    | 25        | Hydrostatics and Pressure                 | 11.1-11.6            |
| 24    | 28        | Buoyancy                                  | 11.7                 |
| 25    | 30        | Heat and Temperature                      | 13.1-13.2, 14.1-14.2 |
| 26    | Nov. 1    | Phase Change and Latent Heat              | 13.5, 14.3           |
| 27    | 4         | Electrostatics                            | 18.1-18.2            |
| 28    | 6         | Coulomb's Law                             | 18.3                 |
| 29    | 8         | The Electric Field                        | 18.4                 |
|       | 11        | NO CLASS                                  |                      |
| 30    | 13        | Electric Field Lines                      | 18.5                 |
| 31    | 15        | Magnetic Forces on Charges                | 22.1-22.5            |
| 32    | 18        | Magnetic Forces on Wires                  | 22.7                 |
| 33    | 20        | Sources of the Magnetic Field             | 22.9-22.10           |
| 34    | 22        | Electromagnetic Waves                     | 24.1-24.3            |
| 35    | 25        | Reflection and Refraction                 | 25.1-25.3            |
|       | 27-Dec. 1 | THANKSGIVING BREAK                        |                      |
| 36    | 2         | Image Formation by Lenses                 | 25.6                 |
| 37    | 4         | The Human Eye and the Microscope          | 26.1-26.2, 26.4      |
| 38    | 6         | Exam 3 (Final Exam) Review                |                      |
|       |           | <b>FINAL EXAM: Dec. 13, 8:30-11:30 AM</b> |                      |

You can expect to spend 15-18 hours per week on this course and the accompanying lab PHYS 102L: 6 hours in class and lab, and 9-12 hours outside of class.