

## PHYSICS 200 - COURSE SYLLABUS PHYSICS FOR THE NEW MILLENNIUM

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### COURSE MATERIALS:

**Textbook:** [Conceptual Physics](#), Tenth Edition by Paul G. Hewitt.



### **Suggested Readings:**

Spielberg, N., & Anderson, B. D. (1995). [Seven Ideas That Shook The Universe](#) (2<sup>nd</sup> Ed.). New York: John Wiley & Sons. [ISBN: 0-471-30606-1]

Bohren, C. F. (1987). [Clouds in a Glass of Beer: Simple Experiments in Atmospheric Physics](#). New York: John Wiley & Sons.

**Calculator:** You will need a traditional calculator with exponential capabilities.



**Other:** Pencils and a good ruler.

### GENERAL EDUCATION INFORMATION:

*Physics for the New Millennium* is one of nine second-level courses in Cluster 2 of Curricular Area 5 (The Natural Sciences) within the University's General Education Program. Students who enroll in *Physics for the New Millennium* will have first taken *Physics for the Modern World* the Foundation course in Cluster 2 of Curricular Area 5. General Education credit will be given only if the prerequisite Foundation course has been taken for this course.

*Physics for the New Millennium* will build upon the foundation laid in *Physics for the Modern World*. The content of *Physics for the New Millennium* includes the broad categories of Electricity & Magnetism, Light & Color, and Modern Physics. In an interactive environment students will have the opportunity to explore these broad topics through exposure to such topics as: waves & sound, electrostatics, electromagnetic induction, reflection and refraction, light waves, light quanta, one-dimensional qualitative quantum mechanics, etc. Students may also have the opportunity to study interference of light, laser energy levels, as well as the structure of solids, the structure of the nucleus, and nuclear medicine. Particular emphasis will be placed on hands-on, inquiry-based activities that utilize these topics as a foundation for understanding technological advancements of the past as well as those of the new millennium.

## COURSE GOALS AND OBJECTIVES:

By the end of the semester, students should:

1. **Know basic terms.** Some ways students may be given the opportunity to express their knowledge of basic terms include:

- 1.1 Writing a definition of a specified term.
- 1.2 Providing the term that best fits a particular context.
- 1.3 Selecting the best term when given a definition.
- 1.4 Distinguishing between scalar and vector quantities.
- 1.5 Identifying the appropriate usage of a specified term.



2. **Understand that units must be included when presenting or describing physical data and/or results.** Some ways students may be given the opportunity to express their understanding include:

- 2.1 Converting from the SI to the British system of units and vice versa, using learned techniques.
- 2.2 Distinguishing between units of various physical quantities.
- 2.3 Recognizing the appropriate unit for a given term.
- 2.4 Expressing proper units with each numerical result or data obtained through direct measurement.

3. **Understand fundamental physical concepts and principles.** Some ways students may be given the opportunity to express their understanding include:

- 3.1 Selecting the appropriate law or relationship given a physical description of a situation.
- 3.2 Writing a description of a particular law or principle.
- 3.3 Recognizing an appropriate concept or principle for a given task.
- 3.4 Citing examples which exemplify fundamental laws and principles.
- 3.5 Relating fundamental laws and principles to given physical situations.
- 3.6 Writing a professional paper on a topic which involves the role physics has played (or is playing) in terms of the development of some aspect of our highly technological society that can be linked to a topic(s) to be covered in the course.

4. **Understand appropriate problem solving techniques and methodologies.** Some ways students may be given the opportunity to express their understanding include:

- 4.1 Outlining problem solving methodologies.
- 4.2 Recognizing appropriate uses of problem solving techniques.
- 4.3 Recognizing improper uses of problem solving techniques.
- 4.4 Explaining one's choice of problem solving methodologies.
- 4.5 Applying diverse modes of inquiry and critical reasoning to gather data & solve problems.



5. **Apply fundamental physical laws and principles.** Some ways students may be given the

opportunity to apply fundamental physical laws and principles include:

- 5.1 Distinguishing between appropriate and inappropriate applications of physical laws and principles.
- 5.2 Formulating solutions to problems based on appropriate laws and principles.
- 5.3 Solving problems that require the application of physical laws and principles.
- 5.4 Applying principles to new and different problem solving situations.
- 5.5 Demonstrating appropriate problem solving techniques.

6. **Interpret and draw motion graphs.** Some ways students may be given the opportunity to draw and interpret motion graphs include:

- 6.1 Drawing a graph of a particular motion of interest and determining its slope and y-intercept.
- 6.2 Describing the motion of an object in a given graphical representation.
- 6.3 Making interpretations based on a given graphical representation.
- 6.4 Selecting the graphical representation which best illustrates a given situation.

7. **Synthesize processes for obtaining a solution to a unique conceptual or numerical problem or situation.** Some ways students may be given the opportunity to synthesize processes include:

- 7.1 Using laws, principles, and concepts correctly and effectively.
- 7.2 Devising appropriate problem solving sequences leading to the solution of a unique problem.
- 7.3 Reorganizing given information into logical problem solving sequences.
- 7.4 Justifying the steps taken to solve a conceptual or quantitative problem.
- 7.5 Integrating various concepts learned into an effective problem solving strategy.
- 7.6 Demonstrating an understanding of the structures, patterns, principles, and values that affect the organization of societies and the relationship between the individual and society (with an emphasis on technology and its relationship to the individual and society).
- 7.7 Integrating problem solving and critical thinking skills using quantification, statistical analysis tools, and computer data manipulation.

8. **Appreciate physics.** Some ways students will be given the opportunity to appreciate physics include:

- 8.1 Exploring real-world applications of the concepts, laws, and principles discussed.
- 8.2 Being encouraged to make connections between physics and one's individual major.
- 8.3 Making comparisons between various ways of looking at a given physical phenomenon.
- 8.4 Experiencing hands-on applications of physics, particularly through interactive (and computer-based) activities.
- 8.5 Exploring how scientists build models through which various physical phenomena can be



- analyzed and understood.
- 8.6 Analyzing how science works through the explicit examination of the historical development and current status of scientific methods, concepts, and principles.
  - 8.7 Developing a respect for the finite resources of our planet, responsible use of technology and nuclear power, the limits of humane research, and the fragile wonders of the natural world.

### ATTENDANCE POLICY:

Your presence is required at every class session and you are responsible for all material presented (i.e., discussion material, handouts, demonstrations, announcements, schedule changes, etc.). This course is one that requires you to participate in numerous group and collaborative activities. Thus, your attendance is mandatory in order to ensure the success of the activities for the class as a whole. You must notify me in advance if you are going to be absent from class due to an illness, a university-related activity, or some other excusable activity. If you must be absent from a class session it is totally your responsibility to obtain the missed material. Further, if you must miss a class because of an extreme family or individual emergency or some other unavoidable circumstance, you should inform me as soon as possible (i.e. in advance of missing a class). A doctor's note is required if you are ill and will miss class on the day of an exam, quiz, or paper presentation. In addition, if you are ill on the day of an exam, quiz, or paper presentation you must notify me via telephone PRIOR to the start of class time. An email message is NOT an appropriate means of notifying me in terms of missing an exam, quiz, or presentation. If you know you will need to be absent from class on a particular day you should let me know ahead of time so that proper arrangements can be made to make up any missed class work. **Only when proper arrangements have been made with me in advance will you be allowed to make up a missed assignment, in-class interactive exercise, quiz, exam, etc. Work-related activities do not constitute an excused absence.**

If you miss a class and do not inform me of the circumstances as indicated above, that absence will not be excused. Any work that is missed because of an unexcused absence (including unannounced quizzes and other in-class activities) will be given a zero grade. Attendance will be taken each class period. No points are deducted from your grade for an unexcused absence; however, the total number of unexcused absences will be noted in my grade book at the end of the semester. **Missing more than one class period (i.e., 5% or more of the total number of class sessions) is considered excessive and may lead to the lowering of your overall course grade.** The number of unexcused absences an individual has will be one of the many items I will look at when recording final grades. This is particularly important for borderline situations. It is much easier to give a student with a perfect or nearly perfect attendance record the higher grade in a borderline situation.



### GENERAL USES OF E-MAIL:



I am happy to respond to e-mail. The most appropriate uses of e-mail include: asking a question, clarifying an assignment, sharing general class-related information, etc. Do not send me a "last minute" e-mail on the day of an exam or a quiz telling me you are unable to attend class. This will not be accepted and you will not be allowed to make up the missed exam or quiz. I do not check my e-email around-the-clock and may not see your

message until after an exam or a quiz has been given. To avoid potential miscommunication, always phone me (in advance) or stop by my office if an unavoidable problem or situation arises in which you must be absent on the day of a scheduled exam or quiz.

### **CELL PHONES AND PAGERS:**

Cell phones and pagers are wonderful pieces of technology (and which utilize many good physics concepts!!), but they have no place in a college classroom. If you are a cell phone or pager user, please be sure it is turned off before you come to class. Better yet, leave it at home!!



### **BLACKBOARD:**

As a member of this class, you have been added to the Physics for the New Millennium Blackboard site. I expect you to regularly check the site for updates and announcements. You will be able to access the site using the email address that the university has on file for you (which I assume is your AU email address). **If you are using a hotmail, yahoo, AOL, or other account rather than your AU account, then I ask that you be sure to go into your AU account and have your email forwarded to the account you are actually using.** Please be sure that you have your spam and junk filters properly formatted to ensure that you will receive email with an american.edu extension on it. I want to be sure that everyone in the class receives all of email announcements that I send out. This is very important. Please be sure to check your e-mail every day. *I do not intend to repeat announcements during class that have been made via email.* One feature of Blackboard that I will make use of this semester is the online live chat. I hope to have a “floating time” each week that I can be online to chat with you and answer questions, etc. The “floating time” will help ensure that at least some of the times will work with your schedule. I will post the weekly chat time on the Announcements page in Blackboard as well as send you an e-mail announcement. I will try to do that by Sunday evening so that you can plan the chat time into your schedule for the coming week.

### **GRADING POLICY:**

Each raw score you receive in this class will be standardized for a mean of 75 and a standard deviation of 15. The standard deviation is one measure of the variability of the scores. The procedure for standardization of scores is given below in the section entitled **Determination of Student Grades**. Please note that you are not competing with your classmates for grades. I standardize scores because it is an efficient way of giving each exam, quiz, homework set, etc. an appropriate weighting. The procedure for standardizing scores is very straight forward and allows a grade distribution to be established based on actual class performance.

The distribution of course grades in a **typical semester** for *Physics for the New Millennium* has been approximately: 40% A's, 50% B's, and 10% C's or below. Classes that perform better than average may have distributions of grades that are higher, and classes that perform below average may have distributions of grades that are lower than typical ones.

**Your final grade for this course will be determined on the following basis:**

Hour Exams	200 points or approximately 21.1 % of total points possible
Quizzes	75 points or approximately 7.9 % of total points possible
Homework	150 points or approximately 15.8 % of total points possible
Hands-on Activities	200 points or approximately 21.1 % of total points possible
Conference Paper	175 points or approximately 18.4 % of total points possible
Conference Paper Peer Review	50 points or approximately 5.3 % of total points possible
Conference Presentation	100 points or approximately 10.5 % of total points possible

TOTAL POINTS: 950 (Note: these are standardized points)

### DETERMINATION OF STUDENT GRADES:

On each class activity (exam, quiz, homework set, etc.) you will receive a raw score (RS) and a standard score (SS). The scores will be standardized for a class average ( $x_S$ ) of 75 and a standard deviation ( $\sigma_S$ ) of 15. The standard deviation is simply an indicator of how much above or below the class average a particular score is. If the raw score for a particular class activity has an average value of ( $x_R$ ), and a standard deviation ( $\sigma_R$ ), the corresponding standard score can be determined in the following manner:

$$\text{Standard Score} = 75 + \frac{\text{Raw Score} - \text{Raw Average}}{\text{Raw Standard Deviation}} \times 15$$

The quantity:

$$\frac{\text{Raw Score} - \text{Raw Average}}{\text{Raw Standard Deviation}}$$

is called your evaluation ratio. If you have had some statistics, you might be more familiar with the term z-score. Essentially this ratio indicates where you stand relative to the class average. Please note that standardizing scores does not change your class rank. Your individual scores may be displayed on a summary printout that I will keep posted outside my office. Feel free to stop by and take a look at it any time you like. You will be identified on the printout by the last five digits of your ID number (unless you specifically request otherwise). I will run a new printout after each regular classroom exam and at periodic intervals throughout the semester. I may also post a frequency distribution of total grades outside my office. I will indicate tentative grade cut-offs on the frequency distribution. The grade cut-offs will be marked as A, B, C, etc. You will easily be able to see the range of scores within each grade category. In terms of +/- grades, you will be able to note by inspection whether your individual score is in the top third, middle third, or bottom third of the grade range. This way you will always have a good idea of how you are doing in the class. If you have any questions at all regarding the grading policy, please see me. I will be more than happy to answer any questions you might have.

In addition to the composite grade printout posted outside my office, you may also receive an

individualized grade profile sheet after each exam. The first individualized grade profile sheet will be distributed during class following the first hour exam. After the first exam, you may stop by my office to receive an updated individualized grade profile sheet as often as you like.

**Example:** The following is an example of 20 students' scores (raw and standardized) on a particular exam:

Student	Raw Score	Student	Raw Score
1	65	11	71
2	93	12	86
3	41	13	62
4	72	14	79
5	60	15	74
6	89	16	55
7	97	17	67
8	59	18	40
9	78	19	92
10	63	20	80

Raw Class Average ( $\bar{x}_R$ ) = 71.1

Raw Class Standard Deviation ( $\sigma_R$ ) = 16.1

From this information, the above formula can be used to obtain the individual students' standard scores. The results (rounded to the nearest whole number) using the above information are as follows:

Student	Standard Score	Student	Standard Score
1	69	11	75
2	95	12	89
3	47	13	67
4	76	14	82
5	65	15	78
6	92	16	60
7	99	17	71
8	64	18	46
9	81	19	94
10	67	20	83

**ABOUT THE EXAMS:**

There will be two regular hour exams this semester. The exams will focus on conceptual as well as problem-based questions. In addition, exam questions may be related to our hands-on activities. An equation and review sheet will be given at least one class period prior to each exam. I do not require that you memorize equations, rather I want to see that you know how to select and apply appropriate relationships



to given physical situations. Always be sure to clearly identify your methods and techniques as you solve numerical problems. You should also provide written explanations as necessary. I will not give credit for answers alone without proper justification. I do give partial credit when sufficient work is presented in a solution. The use of dictionaries is not allowed during exams and quizzes. Only traditional calculators will be permitted for use during exams.

### ABOUT THE QUIZZES:

We will have three regularly scheduled quizzes throughout the semester. You may be given an occasional unannounced or take-home quiz as well. You will be allowed to drop your lowest quiz score at the end of the semester. If you miss class on the day a quiz (or exam) is given due to an excused absence you will be allowed to make up that quiz (or exam). However, if you miss class due to an unexcused absence on the day a quiz (or exam) is given then you will receive a zero grade for that quiz (or exam). I must be notified PRIOR to your absence in order for you to be allowed to make up a quiz (or exam). Note: All quizzes are given at the beginning of the class session. If you are late for class, you will forfeit work time - all quizzes are collected at the same time. Furthermore, if you are substantially late, you will forfeit the opportunity to take the quiz and you will receive a zero grade for it. Once a quiz has been distributed, the classroom door will be closed. No one will be allowed to enter the classroom until after the quiz has been collected.

### ABOUT THE HOMEWORK:

All homework assignments will be collected and graded. Homework assignments will typically consist of **Review Questions (RQ)**, **One-Step Calculations (OSC)**, **Exercises (E)**, and **Problems (P)** from your text. The Review Questions and Exercises are highly conceptual and will give you a chance to express your understanding of the concepts in written form. The Exercises are somewhat more challenging and often require you to apply one of more concepts simultaneously. The Problems allow you to express your understanding through numerical computations. In addition to the problems found in your text, you will also receive **Supplemental problems (SP)** that are to be completed and turned in as part of your regular homework assignment. The SP will be posted in the Assignment section of our class Blackboard site. Your homework assignments from the text can be found on the class schedule. There you will also find additional information as to what my expectations are regarding your homework assignments. Your SP assignment sheet will be posted to our class Blackboard site and will not be distributed in paper copy during class.



Homework is due at the beginning of class on the designated dates. Once a homework set is graded and returned to you, the solutions will be kept in a notebook in my office. I do not allow photocopies of these solutions to be made. However, you are welcome to sit in my office and view them for as long as you like.

No credit will be given for homework turned in after an assignment has been graded and returned to the class. However, homework turned in after the designated collection time and before it is returned to the class will receive 1/2 credit.

Some occasional in-class exercises may also be included as part of your homework assignments. Many times these will take the form of what I term “Classroom Assessment Techniques” (i.e. CATs). You will receive a certain amount of homework credit each time you complete one of these exercises. My intent in giving you these exercises is to allow you to discover any shaky logic you might have on a given topic before a major exam or quiz. This will allow you to make adjustments and to come in and see me for help as necessary.

**You are encouraged to work together on the homework assignments, but it is assumed that the work you turn in is your own.** Written solutions and explanations that are identical to a classmate’s solutions and explanations give rise to the need for me to question the integrity of your work. **When you write your name on the top of each activity you submit, that is your written assurance to me that the work that you have done is completely your own.**

### **ABOUT THE HANDS-ON ACTIVITIES:**

Throughout the semester you will perform a number of interactive, hands-on (and minds-on!) activities that relate to the material being discussed during class. These activities will range in length from 5 minutes to an hour (or more). Many of the activities will require that you fill out and complete worksheets to demonstrate your understanding of various phenomena. You may also be asked to complete other short assessments before or after completion of an activity. The assessments will be designed to enhance and challenge your understanding of the physics phenomena being studied. Most of the hands-on activities will be done during our Friday afternoon class session. Except in very rare, emergency-type situations, make-ups will not be allowed for these activities.



### **ABOUT THE CONFERENCE PAPER AND PRESENTATION:**

On Friday, April 25<sup>th</sup> each of you will be participating in the 8<sup>th</sup> *annual New Millennium Conference*. The conference will run from approximately 11:20 am - 5:00 pm so plan your schedules accordingly. (You will be given one free class period during the semester to work on your papers to compensate you for this longer class period). The central theme of the *New Millennium Conference* will be to share ways in which physics has played (or is playing) a role in terms of the technological advancements present in our society. The conference outline will be rather broad-based to allow each of you to write about and present material that is relevant to your lives and is of particular interest to you. You will be given additional details about the *New Millennium Conference* during class.



You will write your conference paper in a professional style following a format that will be shared with you during class. You will begin by writing an abstract. Once your abstract has been accepted (and it **WILL** be accepted), you will then produce a draft of your conference paper. Your paper draft will be critiqued by one of your classmates as well as by me. Final paper drafts will be due **immediately after** mid-term break. By the end of the semester each of you will have produced a conference paper that is in a camera-ready and publishable format. Each of your papers will be “published” in our conference proceedings. You will be given a copy of the conference proceedings for your personal academic portfolio. Guidelines as to presentation

style, length, and format will be provided to you in class.

### USE OF COMPUTERS IN THE CLASSROOM:

Physics is not the type of course that lends itself easily to the use of computers in the classroom. You will make extensive use of computers in the laboratory and those will be provided for your use. However, within the classroom environment, the use of computers can be very distracting for those around you. If you have a circumstance in which you need to bring a computer into the classroom, then you must get that approved by me (in advance). In addition, you will need to sign a contract with me regarding the appropriate use of computers in the classroom. The bottom line is that I prefer that computers not be brought into the classroom at all and will handle individual situations on a case-by-case basis. Thank you for your understanding and cooperation.

### ACADEMIC INTEGRITY:

The university's academic integrity policy is expressed in the Academic Integrity Code and in the Student Handbook which illustrates the procedure to be used in case of violations to the code. This procedure will be strictly adhered to in this course. Any situations involving academic dishonesty will be reported to the Dean of the College of Arts and Sciences. The Academic Integrity Code can be found on-line at: <http://www.american.edu/academics/integrity/index.htm>.

### ACADEMIC SUPPORT SERVICES AVAILABLE ON CAMPUS:

If you experience difficulty in this course for any reason, please don't hesitate to consult with me. In addition to the resources of the department, a wide range of services are available to support in your efforts to meet the course requirements. These services include:

**Learning Services (x3360)** offers study skills workshops, individual instruction, tutor referrals, and services for students with learning differences.

**Psychological Services (x3360)** offers counseling and consultations regarding personal concerns, self-help information, and connections to off-campus mental health resources.

**Disability Support Services (x3315)** offers technical and practical support and assistance with accommodations for students with physical or psychological disabilities.

### MY OFFICE HOURS ARE: ☺

Monday: 2:00 – 4:00 PM  
Tuesday: 2:00 – 4:00 PM  
Wednesday: By appointment  
Thursday: 10:00 – 11:00 AM  
2:00 – 3:00 PM  
Friday: By appointment



**Please feel free to stop in for help during my regularly scheduled office hours. If these times do not work for you, I am happy to set aside an alternate time to meet with you.** Feel free to call or e-mail



me to set up an appointment. You are always welcome to call me at home. You may also feel free to simply “drop by.” If you happen to drop by and find that I’m busy working with someone else, feel free to interrupt and schedule a time to stop back and see me. Don’t ever feel embarrassed or afraid to ask for help. Working with you is one of the most enjoyable aspects of my job. I truly look forward to working with and getting to know you this term.

**Let’s have a great semester!!**