

**PHYS-201: FUNDAMENTALS OF PHYSICS III**  
**Winter Quarter 5 January — 21 March 2009**

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**Course Objective:** The course *Fundamentals of Physics III* introduces the basic conceptual understanding of modern physics needed to keep up with rapidly developing frontiers of science and technology of the 21st century. The end of the 19th and beginning of the 20th century faced dramatic changes in understanding of basic physics principles. Prior to this time, physics dealt with Newton's laws of motion and gravitation, Maxwell's theory of electromagnetism, thermodynamics, and kinetic theory. However, new problems surfaced when scientists confronted very high velocities and very small lengthscales. These new puzzles led to new concepts and new theories: special and general relativity, quantum theory, modern models of atoms and molecules, lasers, superconductivity, and more. This course is a serious though relatively non-mathematical introduction to modern physics concepts. The course begins with a mathematical description of mechanical and electromagnetic wave propagation and proceeds to description of wave phenomena, such as interference and diffraction. In quantum mechanics which dominates physical world at small lengthscales the concepts of a particle and wave merge into one dual description. A particle (e.g. an electron) can be treated either as a particle or as a wave, depending on the experimental situation under consideration. Similarly, electromagnetic radiation can be mathematically described either as a wave or a particle (photon). When the relative velocity of an object with respect to the observer approaches the speed of light, special relativity phenomena have to be taken into account. The course covers some of special relativity phenomena such as length contraction, time dilation, relativistic momentum & energy, and mass-energy relationship.

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**Course Coordinator: Brigita Urbanc**

E-mail: brigita@drexel.edu

Phone: (215) 895-2726

Office: Disque 909

Lectures: Mon & Wed 9:00am—9:50am (CURTIS-341)

[Note: first lecture (Mon, 5 Jan) last lecture (Mon, 16 Mar)]

**Recitations: Tim Jones & Trevor King**

E-mails: tdj28@drexel.edu & wking@drexel.edu

Recitations/Discussions:

Tue 9:30am—10:50am (STRATN-219)

Tue 11:00am—12:20pm (RANDEL-328A)

Tue 2:00pm— 3:20pm (CURTIS-255A)

**Labs: Rachael Kratzer & Soumya Gopinathan**

E-mails: rmk55@drexel.edu, sg562@drexel.edu

Labs: (Disque 820A)

Thu 9:00am—10:50am : Soumya Gopinathan

Thu 11:00am—12:50pm : Soumya Gopinathan

Fri 9:00am—10:50am : Rachael Kratzer

Fri 11:00am—12:50pm : Rachael Kratzer

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**Help/Office hours:** Address all questions related to (a) labs to Rachael Kratzer & Soumya Gopinathan; (b) homework and recitations to Tim Jones & Trevor King; and (c) lectures and exams to Brigita Urbanc. Individual office hours will be announced on the PHYS-201 web site (<http://www.physics.drexel.edu/students/courses/phys201>) sometime during the first week of classes. In the case you need to contact instructors, use e-mail addresses.

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### Course Material:

- Text: Serway & Jewett, Principles of Physics (A Calculus-Based Text), 4th Edition, Volumes 1 & 2, Thomson Brooks/Cole, 2006 (ISBN 0-534-41944-8; ISBN-13: 978-0-495-40711-9; ISBN-10: 0-495-40711-9)
  - Lab: Download and print the pdf file of each experiment and bring the hard copy to the lab session (<http://www.physics.drexel.edu/~wking/phys201/labs.shtml>).
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### Lectures:

- (a) Read the relevant chapter(s) from the course textbook **before** each lecture.
- (b) 100% lecture attendance is required. Failure to attend the lectures will result in reduction of your final grade at instructor's discretion.
- (c) All cell phones should be turned off during the lecture.
- (d) Active participation in the classroom is expected.

### Labs:

- (a) Lab measurements will be completed during one two-hour lab period. Those registered for Friday labs will complete them with Rachael during the even weeks of this quarter. Those registered for Thursday labs will complete them with Soumya during the odd weeks of the quarter. Check the syllabus below and your schedule to determine when you need to report to the lab.
- (b) Attendance at all scheduled labs is required. Failure to attend and complete the labs will result in a non-completed course grade at the instructor's discretion. If you must miss a lab for legitimate reasons (i.e. illness, etc.), please inform your lab instructor as soon as you know. Time is allotted at the end of the quarter for students to make up labs missed for legitimate reasons, and make-up labs will be granted to students at the discretion of their lab instructor.
- (c) Lab grades will be computed as follows:
  - (i) **Prelabs** : 25%

Prelabs for each lab are to be completed and submitted **before** the start of each lab session. Prelabs submitted after the first 20 minutes of the lab session will not receive more than half credit. Prelabs for each lab can be found at <http://www.physics.drexel.edu/~wking/phys201/labs.shtml>.

(ii) **Experiment** : 40%

You are expected to read the lab instructions before you arrive at the lab. Any lab member that appears to be unfamiliar with the lab material (i.e. expecting the lab instructor or other group members to complete the entire lab) will lose points. Each group must submit a copy of the data collected with **all** members signing it before leaving the lab. Each student should also keep a copy of the experimental data for use in his/her lab report. Lab material is available on the course web site (<http://www.physics.drexel.edu/students/courses/phys201>).

(iii) **Lab Report** : 35%

You need to prepare your report at home and submit it at the next regularly scheduled lab (submission procedures for the final lab will be discussed in lab by your lab instructor). Grades for late lab reports will be reduced by 10% per day late. Lab reports submitted one (1) week after the due date will receive **NO** credit.

Each report should consist of: (1) a brief summary of the purpose and procedures of the experiment; (2) one or more tables of raw data and results, including the graphs; (3) a description of your final results with an assessment of the factors affecting their accuracy; (4) answers to any questions posed in the lab; and (5) a discussion of what you personally learned from doing the experiment. Again, lab material is available on the course web site (<http://www.physics.drexel.edu/students/courses/phys201>).

**Recitations/Discussions:**

- (a) 100% attendance at all scheduled recitations is required. Failure to attend the recitations will result in reduction of your final grade at instructor's discretion.
- (b) There will be six homework assignments which you will download from the course web site (<http://www.physics.drexel.edu/students/courses/phys201>). Each assignment will consist of 5 standard homework problems which will count towards 100% of the homework grade and an additional bonus problem that will be more challenging and will allow you to gain extra points. You should NOT solve the bonus problem as a replacement for one of the standard problems. The solution of the bonus problem will not count unless solutions to all standard problems are provided.
- (c) The homework assignments are due in your recitation TA's office (ask your TA for details) by the date shown in the schedule at the end of the syllabus. All six homeworks must be completed, and late homeworks will not be accepted.

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**Academic Honesty:** All work during the exams must be your own unaided effort. The homework that you submit must be your own final product, although discussion of strategies and numerical results with others is acceptable. Each member of a lab group must take her/his own notes and write her/his own summarizing essay. In all other situations, active cooperation and peer teaching among students is strongly encouraged.

**Tentative Course Schedule:**

Note that on the Martin Luther King, Jr. Day (Monday, 19 Jan. 2009) there are NO classes scheduled. The last day to withdraw from the course is Friday, 13 Feb. 2009.

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**Grading Information:**

Your letter grade will be based on your total score, obtained from the following components with the indicated weighting (contribution). Dates of all exams (Exam 1, Exam 2, Exam 3, and Final Exam) will be posted on the course web site (<http://www.physics.drexel.edu/students/courses/phys201>).

TABLE I: GRADING

| Grade Components             | Contribution |
|------------------------------|--------------|
| Exam 1 (1hr)                 | 10%          |
| Exam 2 (1hr)                 | 10%          |
| Exam 3 (1hr)                 | 10%          |
| Final Exam (2hrs)            | 30%          |
| Four Lab Reports             | 20%          |
| Homework Assignments (H1-H6) | 20%          |

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TABLE II: TENTATIVE SYLLABUS

| TIME-LINE                      | TOPICS  | CHAPTERS       | HOMEWORK      | LABS           | EXAMS  |
|--------------------------------|---|----------------|---------------|----------------|--------|
| WEEK 1<br>5 & 7 Jan.           | Oscillatory Motion & Waves<br>Mechanical Waves              | Ch.12<br>Ch.13 | H1<br>Jan. 12 |                |        |
| WEEK 2<br>12 & 14 Jan          | Superposition and Interference<br>Maxwell's Eqs. & EM Waves | Ch.14<br>Ch.24 | H2<br>Jan. 20 | Lab 1<br>Lab 1 |        |
| WEEK 3: 21 Jan.                | Interference & Diffraction                                  | Ch.27          | H3<br>Feb. 2  | Lab 1          |        |
| WEEK 4<br>26 & 28 Jan.         | Lasers & Holography<br>Quantum Physics & Planck's Theory    | Ch.27<br>Ch.28 |               | Lab 2<br>Lab 2 | Exam 1 |
| WEEK 5<br>2 & 4 Feb.           | Photoelectric Effect<br>Bohr Model of Hydrogen              | Ch.28<br>Ch.11 | H4<br>Feb. 16 | Lab 2<br>Lab 2 |        |
| WEEK 6<br>9 & 11 Feb.          | Bohr Model of Hydrogen<br>Special Relativity                | Ch.11<br>Ch.9  |               | Lab 3<br>Lab 3 | Exam 2 |
| WEEK 7<br>16 & 18 Feb.         | Special Relativity<br>Mass Energy Relationship              | Ch.9<br>Ch.9   | H5<br>Mar. 2  | Lab 3<br>Lab 3 |        |
| WEEK 8<br>23 & 25 Feb.         | X-Rays & Compton Effect<br>Wave Particle Duality in QM      | Ch.28<br>Ch.28 |               | Lab 4<br>Lab 4 | Exam 3 |
| WEEK 9<br>2 & 4 Mar.           | Heisenberg's Uncertainty Principle<br>Schrodinger Equation  | Ch.28<br>Ch.28 | H6<br>Mar. 17 | Lab 4<br>Lab 4 |        |
| WEEK 10:<br>9 & 11 Mar.        | Appls. of Schrodinger Equation<br>Atomic Physics            | Ch.28<br>Ch.29 |               |                |        |
| WEEK 11: 16 Mar.<br>17-21 Mar. | Hydrogen Atom<br>N/A  | Ch.29<br>N/A   |               |                | Final  |