PHYSICS 0175: Basic Physics for Science and Engineering II

Summer 2019

Lecture: Mon/Wed 12:30PM-3:30PM, Tues/Thurs 12:30PM-2:25PM, Thaw 104

Recitation: Tues/Thurs 2:30PM-3:30PM, with TA

Contact Information:

Instructor: Dr. Melanie L. Good

Office Hours: Fridays 10:00AM-12:00PM, 113D Old Engineering Hall

Email: mlgood@pitt.edu

Textbook:

- **REQUIRED:** *University Physics, Volume 2* by OpenStax
  `https://openstax.org/details/books/university-physics-volume-2`
- RECOMMENDED: *Fundamentals of Physics* by Halliday, Resnick, and Walker, 11th edition, ISBN 9781119455608

Course Description: Physics 0175 is the second term of a two-term calculus-based introductory lecture-demonstration sequence in physics primarily for students intending to major in a field of science or engineering. Calculus is used as needed, and should be taken at least concurrently.

This course covers electricity, magnetism, circuits, electromagnetic theory and optics. Students planning to major in physics are urged to take the equivalent honors course (Physics 0476)

Prerequisites: A "C" or greater in PHYS0174 and MATH 0235

Corequisites: Math 0230 (if MATH 0235 is not complete)

Note: This course will be a VERY compressed version of the full semester in a short six weeks. The pace of the material being covered will move extremely fast. Attendance at EVERY class is necessary for success, and keeping up with the coursework is imperative. Because of the fast pace of the course, is not possible to make up assignments, in-class work, or exams. While the lowest exam will be dropped, it is strongly encouraged not to miss any exams. If you have travel plans that will require more than one absence from class, you are urged to consider taking this course in a different session instead.

Topics to be covered include:

- Electric Charges and Fields (Ch.5)
- Gauss' Law (Ch.6)
- Electric Potential (Ch.7)
- Capacitance (Ch.8)
- Current and Resistance (Ch.9)
- Direct-Current Circuits (Ch.10)
- Magnetic Forces and Fields (Ch.11)
- Sources of Magnetic Fields (Ch.12)
- Electromagnetic Induction (Ch.13)
- Inductance (Ch.14)
- Alternating-Current Circuits (Ch.15)
- Electromagnetic Waves (Ch.16)
- Images and Interference (I)
- Diffraction (II)

Note: last two topics not included in OpenStax, Volume 2, generically referred to as I and II. No required textbook will be needed for these.

Course Objectives:

The department has clearly-defined Learning Objectives for the course, listed below, and also available online: https://www.physicsandastronomy.pitt.edu/sites/default/files/PHYS_0175_Learning_Objectives_2017.pdf :

PHYS 0175 Learning Objectives

1. Use Coulomb's law to calculate the forces between two or more point charges.
2. Describe how charge redistributes itself as conductors are touched to insulators, other conductors, and/or grounded.
3. Calculate the electric field due to one or more point charges.
4. Integrate to find the electric field due to an extended charge distribution (line, arc, or ring).
5. Describe the behavior of a dipole placed in an electric field (in terms of torque and potential energy).
6. Find the electric field due to a symmetric extended charge distribution using Gauss's law. Alternately, determine the amount of induced charge on the surface(s) of a conductor.
7. Calculate the electric potential due to a system of point charges.
8. Sketch the electric field and/or potential for a charge distribution.
9. Integrate to determine the electric potential from a continuous charge distribution (line, arc, or ring).
10. Use the relationship between electric potential and electric field to convert from one to the other.
11. Determine the potential energy of (or the work needed to assemble) a system ofcharges.
12. Find the energy stored in a capacitor's electric field.
13. Describe the effects of dielectrics on capacitors in terms of the electric field, capacitance, and energy stored in the capacitor.
14. Determine the charge, capacitance, or voltage of one or more capacitors in series and parallel.
15. Convert between current, current density, and drift velocity.
16. Apply the definitions of resistance and resistivity, and convert between the two.
17. Find the power dissipated by a resistor in a circuit.
18. Apply Kirchhoff's laws to a single-loop or multi-loop circuit to find the current(s). Circuits may include ideal or real batteries.
19. Calculate the voltage between two points in a circuit.
20. Determine the equivalent resistance, current, or voltage for resistors in series andparallel.
21. Find the time constant, current, and/or voltage of a capacitor in an RC circuit at a particular time.
22. Find the force on a moving charged particle due to a magnetic field.
23. Apply the ideas of crossed fields and/or centripetal motion to solve for an unknown given a set of measurable quantities. Examples include Tompson's apparatus and the Hall effect.
24. Determine the magnitude and direction of the force acting on current carrying wires.
25. Calculate the magnetic field of one or more wires (including solenoids and toroids) using the Biot-Savart law or Ampere's Law.
26. Sketch the magnetic field of one or more wires (including solenoids and toroids).
27. Calculate the magnitude and direction of an induced current from a changing magneticflux.
28. Determine the inductance or mutual inductance of a system.

29. Find the current at a particular time in an RL circuit.

30. Calculate the energy stored in the capacitor/inductor in an LC or undriven RLC circuit.
31. Find resistance, capacitance, inductance, reactance, impedance, phase angle, power factor, current amplitude, and/or voltage amplitude in an RLC circuit.
32. Know the relationships between phase, resonance, and terms like "capacitive."
33. Determine the average power produced by a generator and/or dissipated by one or more resistive loads.
34. Calculate the voltage, current, and/or equivalent resistance transformations of an ideal transformer and identify the circumstances where maximum power is transfered from a source to a load.
35. Calculate the displacement current and/or induced magnetic field from a changing electric flux.
36. Determine the energy transported by an electromagnetic wave and/or the amplitudes of the electric and magnetic fields.
37. Calculate the angle of reflected and/or refracted light rays, and identify total internal reflection.
38. Evaluate the intensity of a light source after it passes through one or more polarizers. The light source could be polarized by reflection at Brewster's angle.
39. Locate the maxima or minima caused by double-slit interference (could be combined with diffraction).
40. Calculate the effects of interference from a thin film.

Tentative Schedule:

Wk	Mon	Tues	Wed	Thurs
1	**May** 13 (Ch.5) [L1/L2]	14 (Ch.5) [L3/L4]	15 (Ch.5) [L5/L6]	16 (Ch.6) [L7]
2	20 (Ch.6 & 7) [L8] **Exam 1**	21 (Ch.7) [L9/L10]	22 (Ch.7 & 8) [L11-L13]	23 (Ch. 8 & 9) [L14/L15]
3	27 X	28 (Ch.9 & 10) [L16/L17]	29 (Ch.10) [L18]**Exam 2**	30 (Ch.10 & 11) [L19/L20]
4	**June** 3 (Ch.11) [L21/L22]	4 (Ch.12) [L23/L24]	5 (Ch.12 & 13) [L25/L26]	6 (Ch.13 & 14) [L27/L28]
5	10 (Ch. 14 &15) [L29] **Exam 3**	11 (Ch.15 & 16) [L30/L31]	12 (Ch.16) [L32/L33]	13 (Ch. 16 & I)[L34/L35]
6	17 (I) [L36/L37]	18 (II) [L38/L39]	18 (II) [L40/review]	20 **FINAL EXAM**

X = No Class

Chapters and Roman numerals refer to topics above; L1, L2, etc are corresponding lecture numbers

Grading Scheme:

Grading Scheme:
15% Recitation Work
10% Homework
5% In-class work
40% Midterms (Lowest one dropped)
30% Final Exam

Important Dates:
May 15 Add/Drop Ends
May 27 Memorial Day–No Class
May 20 Exam 1
May 29 Exam 2
June 7 Withdrawal Ends
June 10 Exam 3
June 20 Final Exam

Honor Code:

Students are expected to uphold the University's standard of conduct relating to academic honesty.

Students assume full responsibility for the content and integrity of the academic work they submit.

Students shall be guilty of violating the honor code if they:

1. represent the work of others as their own
2. use or obtain unauthorized assistance in any academic work
3. give unauthorized assistance to other students
4. modify, without instructor approval, an examination, paper, record, or report for the purpose of obtaining additional credit
5. misrepresent the content of submitted work

Any student violating the honor code is subject to receive a failing grade for the course and will be reported to the Vice President of Academic Affairs.

Disability Services:

If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services no later than the second week of the term. You may be asked to provide documentation of your disability to determine the appropriateness of accommodations. To notify Disability Resources and Services, call (412) 648-7890 to schedule an appointment. The Disability Resources and Services office is located at 140 William Pitt Union, and is open Monday-Friday from 8:30AM to 5:00PM.