

PHYSICS 152 — COLLEGE PHYSICS II

UH MANOA — Fall Semester 2016

Course Information & Policies

Updated 8/22/2016

Lecture

MWF 12:30–1:20 p.m.
Physical Science Building (“PSB” or “PhySci”), Rm. 217

Instructor

Mr. Michael Nassir
E-mail: nassir@hawaii.edu
Office: Watanabe Hall, Rm. 426, (808) 956-2922 (office hours by appointment)

Problem Sessions: *TO BE ANNOUNCED, starting second week of semester*

FREE Tutoring/Help:

see “Getting Help”
section below for
more info

- Physics TA tutoring in Watanabe 421
 - starts week of Aug. 29
- Natural Sciences Learning Emporium Physics tutoring in Bilger Addition 209
 - starts week of Aug. 29
- Learning Assistance Center tutoring in Sinclair Library
 - starts week of Aug. 29
 - one-on-one sessions, online appointment needed >24 hrs. in advance

Required Materials

TEXTBOOK: OpenStax, *College Physics*, 1st ed. (2013), Chaps. 18–33

Available via: <https://openstax.org/details/college-physics>

- PDF version (free — download either low- or high-resolution)
- Web-based version (free — requires real-time Internet access)
- Enhanced iBooks version (\$5) (available only for Apple devices)
- Hardcover print version (\$48.50 new via Amazon.com)

ONLINE HOMEWORK:

- Via **ExpertTA** — roughly \$27 per semester
- *Details coming soon*

SCIENTIFIC CALCULATOR with scientific notation, trig functions, exponents, & logarithms — bring to lab & exams (necessary!) and lectures (useful for some in-class problems). *Graphing or programmable calculators are allowed, but NOT necessary. **Smart phones, tablets, computers, or similar devices are NOT permitted during exams!***

Optional Books

Gonick & Huffman, *The Cartoon Guide to Physics* (1990) paperback (~\$18 new, ~\$14 used at UH Bookstore)

PHYS 152 Course Description

Physics 152 continues a two-semester introduction to the fundamentals of physics begun in Physics 151, and will cover electricity, magnetism, optics, special relativity, and atomic & nuclear physics. Lectures and problem-solving will regularly use the mathematical tools of algebra, geometry, trigonometry, and vectors, but *not* calculus.

Prerequisites:

- A grade of “C” or better in **PHYS 151**
- A grade of “C” or better in **MATH 140 (trigonometry & pre-calculus) or MATH 215 or higher**; or instead, a passing score on the Mathematics Department’s Math Placement Exam (≥ 14 on Part I & ≥ 10 on Part II).

Lab: If you also need to take PHYS 152L lab, it is strongly recommended that you do so concurrently with the lecture; the lab provides a hands-on way of reinforcing and complementing many of the topics presented in lecture. However, concurrent enrollment in PHYS 152L lab is *not* mandatory for all students in PHYS 152 lecture.

PHYS 152 Learning Outcomes — General

Upon successful completion of this course, students should be able to:

- Define and use the terminology of electricity, magnetism, light & optics, and modern physics.
- Apply the equations and principles of non-calculus-based physics to solve a wide range of problems in electricity, magnetism, light & optics, and modern physics.
- Incorporate terminology, equations, and principles from mechanics, waves, fluids, and thermodynamics (PHYS 151) when appropriate.
- Recognize how and where these principles occur in natural phenomena, technological and professional applications, and daily life.

PHYS 152 Learning Outcomes — Detailed

Upon successful completion of this course, students should be able to:

- Describe the nature and location of net electric charge on the atom and macroscopic objects, and apply Coulomb’s Law to calculate the resulting force.
- Understand the relationship of electric field to electric force; construct and interpret electric field line diagrams; calculate electric field quantitatively for simple geometries (point charges and parallel plates).
- Define electric potential (voltage) and its relationship to electric potential energy; understand the relationship of electric field and electric potential in both diagrams and equations; calculate electric potential quantitatively for simple geometries (point charges and uniform fields).
- Describe capacitance and dielectric behavior; calculate capacitance for geometry of ideal parallel plates; use equations relating capacitance, potential, charge, and stored energy; understand behavior of multiple capacitors in parallel or series.
- Draw and interpret basic schematic circuit diagrams.
- Understand the nature of current, resistance, and emfs; apply Ohm’s Law and power equations to individual resistors.
- Understand behavior of multiple resistors in series or parallel, and apply Kirchhoff’s Rules to analyze simple and DC circuits.
- Quantitatively analyze R - C DC circuits.
- Describe behavior of magnetic poles and the nature of permanent magnetism in metals.
- Understand magnetic field, and construct and interpret magnetic field line diagrams.
- Find magnitude and direction of magnetic force on moving charges, and quantitatively describe the resulting circular motion.
- Find magnitude and direction of magnetic force on current-carrying wires, including torque on a closed loop of wire.
- Find shape and strength of magnetic field generated by a current in certain simple geometries (infinitely long straight wire, simple loop, ideal solenoid).
- Understand the phenomenon of electromagnetic induction; find magnitude and direction of induced emf using magnetic flux, Faraday’s Law, and Lenz’s Law; understand the source of eddy currents/magnetic braking and basic operation of AC generators.
- Understand self-inductance, and quantitatively analyze L - R DC circuits.
- Understand behavior of resistors, capacitors, and inductors in simple AC circuits, and calculate reactance/impedance for simple AC circuits.
- Understand and calculate resonant response of L - R - C AC circuits, including analogy to a mechanical oscillating system.

- Understand the electromagnetic nature of light waves and their fundamental behavior in both vacuum and matter; know the regions and nomenclature of the EM spectrum.
- Calculate paths of light rays undergoing simple reflection or refraction (using Snell's Law) at interfaces.
- Understand phenomena of dispersion (qualitatively) and polarization (both qualitatively and quantitatively, via Malus's Law and Brewster's Law).
- Understand the function of a lens, and calculate size & location of images formed by a single thin lens or curved mirror.
- Understand the phenomenon of wave diffraction and the interference that results; quantitatively describe interference formed by reflection from a thin layer; calculate locations of maxima/minima for one-slit, two-slit, and grating geometries.
- Understand and calculate relativistic difference of distance and time measurements between two moving observers, using basic Lorentz transformations and equations for relativistic momentum and energy.
- Understand wave-particle duality of both light and matter, qualitative implications, and quantitative treatment via equations (photoelectric effect, photon energy and momentum, DeBroglie wavelength, Heisenberg's Uncertainty Principle).
- Understand basic structure and energy levels of atoms, including formation/absorption of line spectra via electronic transitions.
- Understand the qualitative nature of blackbody (thermal) radiation and formation of continuous spectra, and quantitative application of Wien's Law and Stefan-Boltzmann Law.
- Describe the constituents of the atomic nucleus, their fundamental properties, and their relationship to families of fundamental particles.
- Describe qualitatively the main processes of radioactive decay, fusion, and fission; use conservation laws to balance nuclear & particle reactions; perform quantitative calculations involving decay rates/half-lives and mass-energy conversion.

Grading, Course Work & Exams

• **Final grades** will be computed based on your **overall course percentage**, computed as follows:

Homework (Paper + Online)	30%
Midterm Exams #1 & #2	17.5% each
Final Exam	35%

Final letter-grade cutoffs:	90.0% A+	75.0% B+	60.0% C+	47.0% D+
	85.0% A	70.0% B	55.0% C	43.0% D
	80.0% A–	65.0% B–	50.0% C–	40.0% D–

At the end of the semester, these cutoffs may be lowered at the instructor's discretion, but they will not be raised.

After each major exam, I will publish grade sheets (listed by your “roster numbers,” not names) displaying all of your scores, and I will provide a histogram showing the relative scores of everyone in the class. I urge you to double-check your scores on my grade sheets, as well as the score tallies on your individual papers. While I apologize in advance for any errors, they may well happen with such a large class — please help me to correct them. Final exam scores and final grades will be published (and grades will appear in MyUH) shortly after the term ends.

• **Paper Homework** sheets will usually be due on **Fridays** in lecture (with frequent exceptions due to holidays or exams), and will be graded either by our class grader or by me; please see me outside of class with any questions about grading.

- **Late paper homework** will *NOT* be accepted *for any reason after solutions* for that assignment have been distributed online, usually shortly after the due date.
- All paper homework assignments will be worth the same number of points, and your **TWO lowest paper homework scores** will be **dropped**.

• **Online ExpertTA Homework** will usually be due on **Mondays** at the start of lecture, and will be graded automatically on the website. Your scores likewise will be reported to me automatically. **Late online homework** is allowed with a penalty. Details on how to log in and join our “course” will be provided soon in a separate handout.

• Two **Midterm Exams** will be 50 minutes long, given during regular class periods, to test you on material from the first two-thirds of the course. Roughly one-third of the **Final Exam** will cumulatively review all of this midterm material, while two-thirds of the final exam will test new material from the last third of the course.

Midterm #1	Friday, September 23	Chaps. 18–21
Midterm #2	Friday, October 28	Chaps. 21–23
Final Exam	Friday, December 16, 12:00–2:00 p.m.	Chaps. 24–33 & cumulative review

- You are allowed to bring 1 sheet of **handwritten notes** (no printouts or photocopies) to the first and second midterms. You are allowed to bring 2 sheets to the final exam.
- Do **NOT** let your “cheat sheet” become a substitute for learning formulas and practicing problems! (Graduate school exams, like the MCAT or GRE, do **NOT** allow open notes — you must memorize your formulas.) You will be allowed to retain your “cheat sheets” after each exam to build upon for later exams.
- *You must take all midterms and the final exam to avoid a failing grade in the course.*

• **Reading assignments** are listed in the attached table, and are also printed near the start of each Lecture-Tutorial. The listed reading assignments are the sections of the text that will be covered in lecture and that you will be responsible to know for exams. During lecture, most of the important formulas, concepts, and vocabulary related to each topic will be highlighted, and their correct applications will be demonstrated. I recommend that you skim-read a bit ahead of our current lecture topic, then go back and reread more carefully after lecture. Reading assignments are particularly valuable because they contain additional worked example problems beyond those of our in-class tutorials and homework assignments.

• For each of the assigned sections of our textbook, *I recommend that you attempt as many end-of-chapter problems as your time permits*. The small amount of assigned homework problems is insufficient to fully develop your ability to solve physics problems.

- **Brief answers** to ~50% of end-of-chapter problems are embedded in the Web-based version of the text.
- **Full worked solutions** to ~15% of end-of-chapter problems appear in the free downloadable Student Solution Guide that accompanies our textbook.

PHYS 152 Fall 2016 Calendar & Reading Assignments

• This is the *intended* schedule of topics, however, *actual* subject matter covered during each lecture may lag behind. In that case, exams will only cover material actually discussed in lecture before each exam date. Relevant chapters and sections will be clarified before each exam.

• For all sections and topics listed below in regular type, you will be expected to know and understand the major formulas, concepts, and terminology, and how to apply them correctly to basic and intermediate-level problems.

Exception: For sections/topics listed in *[[brackets]]*, you only need familiarize yourself *qualitatively* with their concepts and terminology. For these sections, you do NOT need to learn any specific formulas, NOR will you be asked to solve any numerical problems for those topics.

DATE	EVENT	READ: OpenStax College Physics
M Aug 22	Lect #1	§18.1-18.2: Electric Charge, Conservation of Charge, Electric Force, Induced Charge Separation <i>[[§18.6: Electrostatic Forces between Molecules]]</i>
W Aug 24	Lect #2	§18.3: Coulomb's Law
F Aug 26	Lect #3	§18.4: Electric Field
M Aug 29	Lect #4	§18.5: E-Field Line Diagrams, E-Field of Multiple Charges
W Aug 31	Lect #5	<i>not in textbook</i> : Field of Infinite Charged Plates §18.7: Equilibrium E-Field of Conductors, Shielding
F Sept 2	Lect #6	§19.1: Electric Potential (Voltage) & Electric PE §19.3: Voltage & Electric PE for Point Charges
(M Sept 5)	HOLIDAY	
W Sept 7	Lect #7	§19.4: Equipotential Lines/Surfaces
F Sept 9	Lect #8	§19.2: Voltage & Electric PE for Parallel Plates
M Sept 12	Lect #9	§19.5: Capacitance & Dielectrics §19.7: Energy Stored in a Capacitor
W Sept 14	Lect #10	§19.6: Capacitors in Series & Parallel
F Sept 16	Lect #11	§20.1: Electric Current §20.2: Simple DC Circuits: Resistance & Ohm's Law <i>[[§21.2: Emf vs. Terminal Voltage]]</i> §20.4: Electric Power & Energy Consumption
M Sept 19	Lect #12	§20.3: Resistivity <i>[[§20.6: Electrical Hazards and the Human Body]]</i> <i>[[§21.4: DC Voltmeters & Ammeters]]</i>
W Sept 21	Lect #13	§21.1: Resistors in Series & Parallel (including Household Circuits) §21.3: Kirchhoff's Rules <i>[[§23.8: Electrical Safety Devices: Fuses & Circuit Breakers]]</i>
F Sept 23	MIDTERM #1	Chaps. 18–21
M Sept 26	Lect #14	§21.6: R-C Circuits (with DC)
W Sept 28	Lect #15	§22.1-22.3: Magnetism, Permanent vs. Electromagnets, Magnetic Field
F Sept 30	Lect #16	§22.4: Magnetic Force on a Moving Charge (Lorentz Force) & Right-Hand Rule
M Oct 3	Lect #17	§22.5: Applications of Lorentz Force §22.11: Mass Spectrometry <i>not in textbook</i> : Superimposed Magnetic & Electric Fields <i>[[22.6: Hall Effect]]</i>
W Oct 5	Lect #18	§22.7: Magnetic Force on a Current-Carrying Wire §22.8: Magnetic Torque on a Current-Carrying Loop (Simple Motor)
F Oct 7	Lect #19	§22.9: Magnetic Field of Current-Carrying Straight Wires, Loops, Solenoids §22.10: Magnetic Force between Parallel Current-Carrying Wires
M Oct 10	Lect #20	§23.1: Magnetic Flux §23.2: Faraday's Law of Induction <i>[[§23.5: Generators]]</i>
W Oct 12	Lect #21	§23.2: Lenz's Law §23.3: Motional emf <i>[[§23.4: Eddy Currents & Magnetic Damping; §23.6: Back emf]]</i>
F Oct 14	Lect #22	<i>[[§23.9: Mutual Inductance]]</i> §23.7: Transformers
M Oct 17	Lect #23	§23.9: Inductors: Self-Inductance, Energy Stored in Solenoid
W Oct 19	Lect #24	§23.10: R-L Circuits (with DC)

F Oct 21	Lect #25	§20.5: Simple AC Circuits (Resistors only)
M Oct 24	Lect #26	§23.11: AC Reactance of Inductors & Capacitors §23.12: Impedance & Oscillations of Series RLC Circuits
W Oct 26	Lect #27	[[§24.1-24.2: Generation of EM Waves & The Speed of Light]] [[§24.4: Energy Carried by EM Waves]] §24.3: The Electromagnetic Spectrum
F Oct 28	MIDTERM #2	Chaps. 21–23
M Oct 31	Lect #28	§25.1: Light Rays §25.2: Reflection §25.3: Refraction (Snell's Law)
W Nov 2	Lect #29	§25.4: Total Internal Reflection §25.5: Dispersion
F Nov 4	Lect #30	§25.6: Thin Lenses: Focal Length & Power, Image Formation
M Nov 7	Lect #31	§25.7: Curved Mirrors: Focal Length, Image Formation
W Nov 9	Lect #32	§27.1, §16.9-16.10: Review of Waves, Superposition & Interference §27.7: Thin-Layer Interference
F Nov 11	HOLIDAY	
M Nov 14	Lect #33	§27.2: Huygens's Principle & Diffraction §27.3: Two-Slit Diffraction & Interference §27.4: Diffraction Gratings
W Nov 16	Lect #34	§27.5: One-Slit Diffraction & Interference [[§27.6: Diffraction by Circular Apertures & Limits to Resolution]]
F Nov 18	Lect #35	§27.8: Polarization, Malus's Law, Brewster's Angle
M Nov 21	Lect #36	§28.1: Einstein's Postulates, Michelson-Morley Experiment §28.2: Simultaneity & Time Dilation (Lorentz Transformation) §28.3: Length Contraction
W Nov 23	Lect #37	[[§28.4: Rel. Addition of Velocities & Rel. Doppler Shift]] §28.5: Rest Mass & Relativistic Momentum [[§28.6: Relativistic Total Energy]] §29.1: Blackbody Radiation <i>not in textbook</i> : Stefan-Boltzmann Law, Wien's Law
F Nov 25	HOLIDAY	
M Nov 28	Lect #38	§29.1-29.3: Energy of a Photon, The Photoelectric Effect §29.4: Photon Momentum §29.6: Wave Nature of Matter, de Broglie Wavelength §29.7: Heisenberg Uncertainty Principle [[§29.5 & 29.8: Wave-Particle Duality]]
W Nov 30	Lect #39	[[§30.1-30.2: Structure of the Atom]] 30.3: Atomic Electron Energy Levels, Absorption & Emission, Discrete Spectra [[30.6-30.9: Electron Quantum Numbers, Pauli Exclusion Principle, Structure of the Periodic Table]]
F Dec 2	Lect #40	[[§31.1-31.2: Radioactivity & Detection]] §31.3: Structure of the Nucleus, Isotopes §31.4: Alpha, Beta & Gamma Decay, Conservation Laws [[§32.2 & 32.4: Biological Effects of Radiation]]
M Dec 5	Lect #41	§32.5-32.6: Fusion & Fission §31.6: Mass & Nuclear Binding Energy §31.5: Half-Life & Decay Rate
W Dec 7	Lect #42	[[§33.2: Four Fundamental Forces, Force-Carrier Particles]] §33.4-33.5: Families of Particles in the Standard Model §33.4: Particle Decays & Conservation Laws
F Dec 16 12:00 noon	FINAL EXAM	Cumulative, with emphasis on Chaps. 24–33

OMITTED sections of textbook:

§18.8: Applications of Electrostatics

§20.7: Nerve Conduction-Electrocardiograms

§21.5: Null Measurements

Chap. 26 (ALL): Vision & Optical Instruments

§27.9: Microscopy & Wave Characteristics of Light

§30.4-30.5: X-Rays & Applications of Atomic Emission

§31.7: Quantum Tunneling

§32.1 & §32.3: Applications of Nuclear Physics

§32.7: Nuclear Weapons

§33.1, 33.3: Accelerator & Particle Physics

§33.6: Grand Unification Theory

Chap. 34 (ALL): Frontiers of Physics

Solving Physics Problems

- You will need a **calculator** with **scientific functions** (trigonometric & exponential/logarithmic functions, and power-of-10 notation) for homework AND EXAMS. (Graphing calculators are not necessary.)

- On all assignments and exams that call for free-response answers, you must **SHOW YOUR WORK**. Writing only the correct final answer without showing your steps is *not* acceptable and will result in little or no credit. It is a central notion in science to show your method along with your results, so that others can follow your reasoning and can question any steps or assumptions. Also, clear and complete explanations will only help you later when you review your own work and study for exams. It is never possible to “show too much work,” but it is easy not to show enough!

Always display your major mathematical steps from your initial formula(s) to your final answer, and annotate your reasoning with sketches and verbal explanations where appropriate. Mathematical steps should read sequentially and logically. Final answers must include **UNITS** and use an appropriate number of **SIGNIFICANT FIGURES**, and sometimes should be written in **SCIENTIFIC NOTATION**. To receive full credit, your answers to **free-response problems** MUST contain the following:

1. **initial formula**, followed by major algebraic rearrangement steps (if necessary)
2. **substitution** (“plugging in” known values), followed by major calculation steps (if necessary)
3. **final answer**, underlined or boxed, with proper **units**, **sci. notation** (if needed), & **significant figures**
4. additional **diagrams** or **comments**, as needed to define quantities (...a picture is worth 10^3 words!)

- **Organization** and **neatness** matter! Both should result naturally if you follow the above format. Disorganized or illegible work will be penalized.

- Please do NOT use **red ink** on any assignments or exams — we reserve that color for grading.

Collaboration

Working in pairs or groups is common in science, and indeed is encouraged: teamwork can help you to make more efficient measurements and to catch errors, and explaining something to another person is a great way to learn it yourself. However, if you are working with a classmate while completing a physics assignment (or while making measurements in lab), there are a few guidelines to follow:

(1) You are strongly encouraged **first to attempt each homework problem YOURSELF, individually** (or, in lab, to make some of your lab measurements yourself). That way, you will get the educational value and the experience that comes from working the problem (or using the equipment) and “seeing for yourself.” Then, after you have tried first on your own, you can compare your answer (or lab results) to others’ work as a “sanity check.”

On homework: If you are stuck on a homework problem, you should seek just enough help to get unstuck. It is unwise to let someone simply feed you the entire solution, since you lose the educational value of working through the problem on your own. If necessary, try changing the numerical values in the problem and attempting it again by yourself, to ensure that you understand completely how to do the problem if you were to encounter it again on your own... say, on an exam.

In lab: If your results differ from other students’ results by only a bit, then *you should keep your own results* — most scientific measurements vary slightly due to “random error” (this will be discussed in lab), so you should *not* change yours to match your classmates’ results exactly. After all, how do you know which result is “correct,” yours or your classmates’? Record what *you* see or measure. (If your results differ *wildly*, then it is appropriate to try to figure out “what went wrong.” Small variations, however, are common and are a natural part of the random error inherent in making measurements.)

(2) All free-response solutions on all submitted assignments should ultimately be **in your own words**, reflecting **your own understanding** of the problems. You should plug numbers into your calculator and attempt (or re-attempt) all calculations *yourself*, even if you received assistance from others along the way.

Any passages or calculations that are **directly copied or plagiarized** from another student (or portions lifted from any other uncited source) will be given a score of **zero**. Again, your submitted work should reflect *your own understanding* of the problems.

In lab: If you make measurements together with a lab partner, make a note in your lab report of who your lab partner was for any particular experiment. Then, be sure that your calculations and the written passages of your lab reports are **in your own words**, even if your initial data or measurements are identical to your partner’s.

(3) During **in-class exams**, **NO collaboration** of any sort is allowed; exams must be *entirely your own work*. Exams copied from another student, even partially, will be given a score of **zero**. Cases of cheating or plagiarism may be referred to the Office of Judicial Affairs for disciplinary review.

Getting Help

- **Regularly-scheduled problem sessions** (solving homework problems, answering questions, etc.) will be scheduled with our Learning Assistants. Times & locations to be announced.

- The **Physics Learning Center in Watanabe 421** is open whenever Watanabe Hall is open, for all students to use to study (alone or together) on physics homework. There are tables, sofas, blackboards, etc., available for your use.

All Physics lab TAs schedule their two weekly office hours in Watanabe 421 as **tutoring hours** — FREE help with any physics homework problems or other physics questions (although lab TAs will give first priority to their own students with lab-related questions). Go to Wat 421 and check the posted schedule for tutoring times.

- The **Natural Sciences Learning Emporium** in Bilger Addition 209 is open M–F, approx. 8am–6:00pm, for all students to seek help with lower-division math or science classes, or just to use the group study tables to work together. Schedules of tutors for physics and all other subjects are posted on the door to BilA 209 and online:

<http://www.hawaii.edu/natsci/physics.php>

- The **Learning Assistance Center** in Sinclair Library offers free, one-on-one tutoring for PHYS 151 & 152 and many other large math & science courses. Appointments are made online, at least 24 hours in advance:

<http://manoa.hawaii.edu/learning/tutoring.html>

- You may also drop by to see me in **my office, Watanabe 426**, during afternoons at times other than the regularly scheduled help sessions. I suggest that you call first (956-2922) to make sure that I am in. Please forgive me if I happen to be busy and ask you to return at another time. You may also make an appointment with me if you wish. For questions about physics problems & concepts, please first try to attend my problem sessions or use one of the above tutoring resources.

- The Department of Physics & Astronomy Office (Watanabe 416) maintains a list of grad students and others who are available for hire as **private tutors** — please stop by Wat 416 and ask the Department secretary for a copy of the list.

Extra Handouts

Extra copies of all handouts from the two or three previous lectures will be brought to every lecture. Most handouts will be available as PDF files in my course Dropbox folders.

Graded Papers

Graded papers will be circulated in lecture once they are graded. Any papers that are not picked up in lecture will be left in the **wooden cubby boxes outside the rear of our lecture hall, PSB 217**. Look for “PHYS 152 Fall 2016,” and find the box for your roster number. Please leave the boxes tidy and organized for your classmates’ benefit! Mahalo.