PHYSICS 152 — COLLEGE PHYSICS II

UH MANOA — Fall 2019 Semester

Course Information & Policies

Instructor — Mr. Michael Nassir
E-mail: nassir@hawaii.edu
Office: Watanabe Hall, Rm. 426, (808) 956-2922
Office Hours: MWF, 1:30-3:00 p.m., or else by appointment

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

Assistance

LA Help Sessions: • Dates & Times TBA
– *starts 2nd week of semester*

Additional FREE Tutoring & Help:

see "Getting Help" section below for more info

• Physics Lab TA office hours/tutoring in Watanabe 421
— *starts 2nd week of semester*
• Natural Sciences Learning Emporium tutoring in Bilger Addition 209
— *starts 2nd week of semester*
• Learning Assistance Center tutoring in Sinclair Library
— *starts 2nd week of semester*
— one-on-one sessions, online appointment needed >24 hrs. in advance

Required Materials

TEXTBOOK: **Young & Adams, *College Physics***, 11th ed. (2020), Chaps. 17–30
• E-book access — included with Mastering Physics (online homework system)
• Looseleaf version — purchase available at discount through Mastering Physics (or UH Manoa Bookstore?)

ONLINE HOMEWORK:
• Mastering Physics — via IDAP purchase (see handout for additional details)

SCIENTIFIC CALCULATOR with scientific notation, trig functions, exponents, & logarithms
• Bring to 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 Book — Gonick & Huffman, *The Cartoon Guide to Physics* (1990) paperback ~~($20 new, $8.25 used at UH Bookstore)]~~ *Not ordered in UH Bookstore this semester?*

Course Materials — Most course materials will be gradually posted throughout the semester as PDFs in a **Dropbox folder** for viewing or download:
https://tinyurl.com/phys152fall19dropbox
• You should NOT need to create a Dropbox account to access these files.
• Any web browser should work.

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.

Course Grades

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

Homework: Paper + Online	**25%**
Top 3 of 4 Midterm Exams	**16% each**
Final Exam	**27%**

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 happen with such a large class — please help me to correct them. I will post the last grade sheet, with Final Exam scores and course letter grades, shortly after the term ends.

Paper Homework

- **Paper Homework** assignments will usually be given roughly once a week.
  - Paper HW due dates will often, *but not always*, be on **Fridays** during our lecture class. Please check each assignment for its due date. Your first assignment will be due **Friday of week #2**.
  - Each Paper HW will be distributed at least one week before it is due.
  - **Late paper homework** will ***NOT*** be accepted for any reason **after solutions** for that assignment have been posted online, usually shortly after the due date. *Before* solutions are published, late assignments will be accepted without penalty — please deliver to me in lecture or under my office door (Watanabe 426).
  - All paper homework assignments will be worth the same number of points. Your **TWO lowest paper homework scores will be dropped**.
  - Papers will be graded either by a student-grader or by me. Please see me outside of class with any questions about grading, as soon as possible after the graded assignment is returned.

Online Homework

• **Online Homework** assignments will usually be given roughly once a week.
   – Online HW due dates will often, <u>*but not always*</u>, be on **Mondays** at the start of our lecture class. Please check each assignment for its due date. Your first assignment will be due **Monday of week #3**.

• Points from Online HW and Paper HW will be added together to form a Homework Total. This HW Total will be weighted to become 25% of your overall course grade.

Exams

• Four **Midterm Exams** will be 50 minutes long, given during regular class periods, to test you on material from every few weeks of the course.
• All Midterms will be worth the same number of points, and your **ONE lowest Midterm score will be dropped**.
• The **Final Exam** will cumulatively test all of the previous midterm material, plus new material from the last month of the course.
<u>**• You must take at least three Midterms AND the Final Exam to avoid a failing grade in the course.**</u>

Exam Dates

Midterm #1	Friday, **September 20**	Chaps. 17–18
Midterm #2	Friday, **October 11**	Chaps. 19–20
Midterm #3	Friday, **November 1**	Chaps. 21–22
Midterm #4	Friday, **November 22**	Chaps. 23–24
Final Exam	Monday**, December 16, 12:00–2:00 p.m.**	Chaps. 25–30 & cumulative review

Exam Note-Sheets

– You are allowed to bring **1 sheet of handwritten notes** (no computer printouts or photocopies) to Midterms #1 & #2.
– You are allowed to bring **2 sheets of handwritten notes** to Midterms #3 & #4 and the Final Exam.
– Your sheets of paper can be no larger than 8.5×11 inches.
– You can use BOTH sides of each sheet.
– You can retain your note-sheets after each exam to build upon for later exams.
– Do NOT let these note-sheets become a substitute for learning formulas and practicing problems! (Graduate-school exams like the MCAT do NOT allow open notes — you must memorize your formulas.)

Reading & Additional Problems

• **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 in advance 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. I recommend that you use your textbook more like a cookbook or manual, instead of reading it through like a novel — *pay attention to boxed formulas, worked examples, and end-of-chapter summaries*.

• For each of the assigned sections of our textbook, *I recommend that you attempt as many* **additional end-of-chapter problems** *as your time permits*. The small amount of assigned homework problems is not sufficient to fully develop your ability to solve physics problems. **Brief answers to all odd-numbered end-of-chapter problems are located in Appendix A.**

Graded Papers

• **Graded papers** will be circulated one time in lecture once they are scored and recorded.
• Any papers that are not claimed during lecture will be left in the **wooden cubby boxes outside the rear of our lecture hall, PSB 217**. Look for "PHYS 152 Fall 2019," and find the box for your roster number. Please leave the boxes tidy and organized for your classmates' benefit. Mahalo!

Solving Physics Problems & "Showing Your Work"

• 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 you will receive little or no credit. Why? 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 work 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!

- Write out all **major mathematical steps** from your **initial formula(s)** to **your final answer.** (Minor algebraic steps and arithmetic calculations can be omitted.) Your lines of mathematical work should read **sequentially and logically**.
- Accompany your math with **sketches**, **diagrams**, and **short written phrases or comments,** where appropriate. Whenever you introduce a new quantity, like an angle or length, create a diagram that clearly shows what the variable represents!
- All numerical values should include **units**.
- Very large and very small values should be written in **scientific (power-of-10) notation**.
- Final answers should be rounded to an appropriate number of **significant figures**.

To receive full credit, your answers to **free-response ("show your work") 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.) Please consult with your lab TA if you have questions about this.

(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 homework 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. Be sure that your final calculations, analysis, and written passages of your lab reports are ***in your own words***, even if your initial data or measurements are identical to your partner's. Please consult with your lab TA if you have questions about this.

(3) During **in-class exams**, **NO collaboration** of any sort is allowed; exams must be *entirely your own work*. Exam answers that are 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 weekly Help Sessions** (assistance with solving problems, answering questions about course content, etc.) will be run by our PHYS 152 Learning Assistants (LAs). *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). The current schedule is posted near the entrance of Wat 421 and online here:
https://www.phys.hawaii.edu/~philipvd/19_fall_intro_labs_uhm.html

• The **Natural Sciences Learning Emporium** in Bilger Addition 209 is open Mon–Fri, 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://uhnatsci.org/emporium/tutorschedules.php

• The **Learning Assistance Center** in Sinclair Library offers free, one-on-one tutoring for PHYS 151 & 152 and many other introductory 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 our LA help sessions or use one of the above tutoring resources.*

• The Department of Physics & Astronomy Office (Watanabe 416) maintains a list of graduate 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.

PHYS 152 Fall 2019 Calendar & Reading Assignments

• This is our *intended* schedule of topics, but 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 each section/topic 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.

• 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: Young & Adams, *College Physics*, 11th ed.**
M Aug 26	Lecture #1	§17.1-17.3: Electric Charge, Conserv. of Charge, Electric Force, Induced Charge
W Aug 28	Lecture #2	§17.4: Coulomb's Law
F Aug 30	Lecture #3	§17.5-17.6: Electric Field
(M Sep 2)	HOLIDAY	
W Sep 4	Lecture #4	§17.7: E-Field Line Diagrams, E-Field of Multiple Charges
F Sep 6	Lecture #5	*not in textbook:* Field of Infinite Charged Plates §17.9: Equilibrium E-Field of Conductors, Shielding
M Sep 9	Lecture #6	§18.1-18.2: Electric Potential (Voltage) & Electric PE, Voltage & Electric PE for Point Charges
W Sep 11	Lecture #7	§18.3: Equipotential Lines/Surfaces
F Sep 13	Lecture #8	§18.3: Voltage & Electric PE for Parallel Plates
M Sep 16	Lecture #9	§18.4, 18.7: Capacitance & Dielectrics §18.6: Energy Stored in a Capacitor
W Sep 18	Lecture #10	§18.5: Capacitors in Series & Parallel
F Sep 20	**MIDTERM #1**	**Chaps. 17–18**
M Sep 23	Lecture #11	§19.1: Electric Current §19.2: Simple DC Circuits: Resistance & Ohm's Law *[[§19.3: Emf vs. Terminal Voltage]]* *[[§19.7: DC Voltmeters & Ammeters]]* §19.4: Electric Power & Energy Consumption §19.2: Resistivity *[[§19.9: Electrical Hazards and the Human Body]]*
W Sep 25	Lecture #12	§19.5, 19.10: Resistors in Series & Parallel (including Household Circuits) §19.6: Kirchhoff's Rules *[[§19.10: Electrical Safety Devices: Fuses & Circuit Breakers]]*
F Sep 27	Lecture #13	§19.8: *R-C* Circuits (with DC)
M Sep 30	Lecture #14	§20.1-20.2, 20.11: Magnetism, Permanent vs. Electromagnets, Magnetic Field
W Oct 2	Lecture #15	§20.2: Magnetic Force on a Moving Charge (Lorentz Force) & Right-Hand Rule
F Oct 4	Lecture #16	§20.3: Applications of Lorentz Force §20.4: Mass Spectrometry, Superimposed Magnetic & Electric Fields *[[not in textbook: Hall Effect]]*
M Oct 7	Lecture #17	§20.5: Magnetic Force on a Current-Carrying Wire §20.6: Magnetic Torque on a Current-Carrying Loop (Simple Motor)
W Oct 9	Lecture #18	§20.7, 20.9: Magnetic Field of Current-Carrying Straight Wires, Loops, Solenoids §20.8: Magnetic Force between Parallel Current-Carrying Wires
F Oct 11	**MIDTERM #2**	**Chaps. 19–20**
M Oct 14	Lecture #19	§21.2: Magnetic Flux §21.1, 21.3: Faraday's Law of Induction §21.3: Simple Generators
W Oct 16	Lecture #20	§21.4: Lenz's Law §21.5: Motional Emf *[[§21.6: Eddy Currents & Magnetic Damping, Back emf]]*
F Oct 18	Lecture #21	§21.7, 21.9: Mutual Inductance; Transformers
M Oct 21	Lecture #22	§21.8, 21.10: Inductors: Self-Inductance; Energy Stored in Solenoid
W Oct 23	Lecture #23	§21.11: *R-L* Circuits (with DC)
F Oct 25	Lecture #24	§22.1-22.2, 22.4: Simple AC Circuits (Resistors only)
M Oct 28	Lecture #25	§22.2: AC Reactance of Inductors & Capacitors, Impedance of Series *RLC* Circts §21.12,, 22.3: Oscillations of Series *RLC* Circuits
W Oct 30	Lecture #26	§23.1-23.4: Generation of EM Waves & The Speed of Light

		§23.3: Regions of the EM Spectrum *[[§23.5: Energy Carried by EM Waves]]*
F Nov 1	**MIDTERM #3**	**Chaps. 21–22**
M Nov 4	Lecture #27	§23.6: Wavefronts vs. Light Rays §23.7: Reflection; Refraction (Snell's Law)
W Nov 6	Lecture #28	§23.8: Total Internal Reflection §23.9: Dispersion
F Nov 8	Lecture #29	§24.1-24.3: Curved Mirrors: Focal Length, Image Formation
M Nov 11	HOLIDAY	
W Nov 13	Lecture #30	§24.1, 24.4-24.6: Thin Lenses: Focal Length & Power, Image Formation
F Nov 15	Lecture #31	§23.10: Polarization, Malus's Law, Brewster's Law Chap. 12, §26.1: Review of Waves, Superposition & Interference §26.3: Thin-Layer Interference
M Nov 18	Lecture #32	§23.11: Huygens's Principle & Diffraction §26.2: Two-Slit Diffraction & Interference §26.6: Diffraction Gratings
W Nov 20	Lecture #33	§26.5: One-Slit Diffraction & Interference *[[§26.8: Diffraction by Circular Apertures & Limits to Resolution]]*
F Nov 22	**MIDTERM #4**	**Chaps. 23–24**
M Nov 25	Lecture #34	§27.1, 27.8: Einstein's Postulates, Michelson-Morley Experiment §27.2-27.3: Simultaneity & Time Dilation (Lorentz Transformation) §27.4: Length Contraction
W Nov 27	Lecture #35	*[[§27.5: Relativistic Addition of Velocities]]* §27.6: Rest-Mass & Relativistic Momentum *[[§27.7: Relativistic Total Energy]]* Chap. 14: Blackbody Radiation, Stefan-Boltzmann Law, Wien's Law
(F Nov 29)	HOLIDAY	
M Dec 2	Lecture #36	§28.1: Energy of a Photon, The Photoelectric Effect, Photon Momentum §28.6: Wave Nature of Matter, de Broglie Wavelength §28.7: Heisenberg Uncertainty Principle, Wave-Particle Duality
W Dec 4	Lecture #37	§28.2-28.3: Structure of the Atom, Atomic Electron Energy Levels, Absorption & Emission, Discrete Spectra *[[§29.1-29.2: Electron Quantum Numbers, Pauli Exclusion Principle, Structure of the Periodic Table]]* *[[§29.3: Spectra from Molecules]]*
F Dec 6	Lecture #38	§30.1-30.2: Structure of the Nucleus, Stable vs. Unstable Isotopes §30.3: Alpha, Beta, Gamma Decay; Conservation Laws; Half-Life & Decay Rate *[[§30.4: Biological Effects of Radiation]]*
M Dec 9	Lecture #39	§30.5-30.7: Fusion & Fission; Mass & Nuclear Binding Energy
W Dec 11	Lecture #40	*[[§5.5: Four Fundamental Forces]]* §30.8-30.9: Families of Particles in the Standard Model; Particle Decays & Conservation Laws; Force-Carrier Particles
M Dec 16 12:00 pm	**FINAL EXAM**	**Cumulative, with emphasis on Chaps. 26–30**

OMITTED sections of textbook:

§17.8: Gauss's Law/Electric Field Calcns.
§20.10: Ampère's Law/Mag Field Calcns.
Chap. 25 (ALL): Vision & Optical Instruments
§26.7: X-Ray Diffraction
§26.9: Holography
§28.4: Lasers
§28.5: X-Ray Production & Scattering
§29.4-29.8: Behavior of Solids
§30.10: Cosmology